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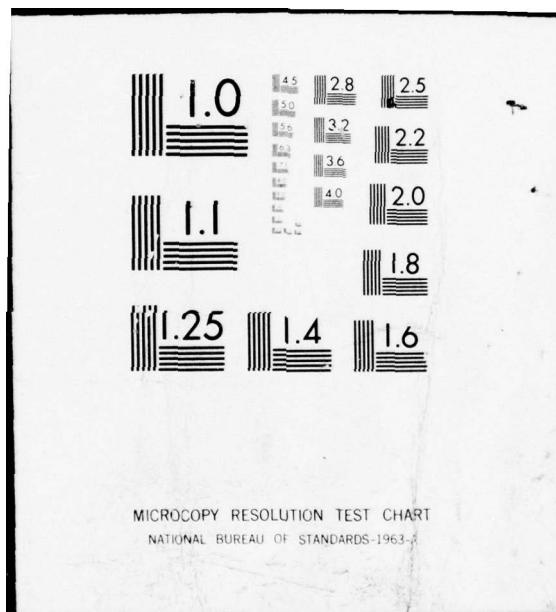
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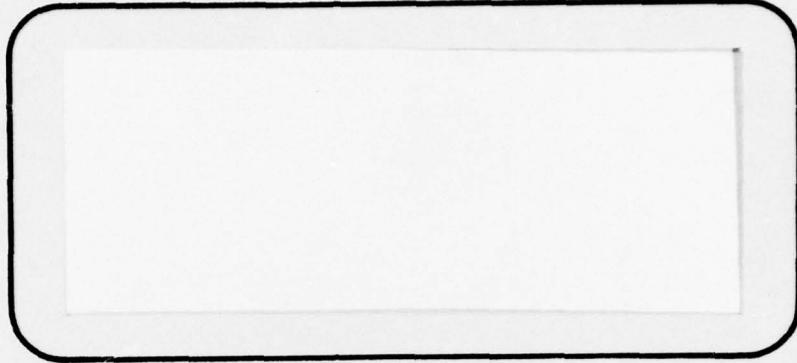




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Shelter Management Research

Volume I

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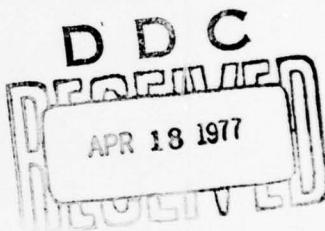
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FOREWARD

This State of the Art report is Volume I of a four-volume study prepared by Fred Carr (retired), Social Scientist, who monitored this research during the 1960's. The other volumes of the report include Volume II, description of studies; Volume IIIA, IIIB, IIIC, IIID, which summarizes major findings of each; and Volume IV, annotated material on specifications and functions of shelter management. An attached reference lists the studies included in this summary report.

The report is being released at this time because of its relevance to the Reception/Care aspects of Crisis Relocation Planning. Plans for the care of dislocated populations in host areas must include provision of food, clothing, temporary housing, and protective shelter, if needed. This report summarizes what is known about human adjustments to shelter living. The other three volumes are being updated with additional summary reports for possible future printing and distribution.

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I. INTRODUCTION AND OPERATIONAL OBJECTIVES

1.1 Purpose

Provision of shelter is the central purpose of civil defense. A nationwide shelter system is considered the most effective measure for saving lives and forming a basis for national survival and recovery in event of nuclear attack. The Federal Civil Defense Guide says:

"Fallout shelter is the core of civil defense. First emphasis must be given to planning the use of the best shelter available at any time. This is, of itself, a broad effort involving not only obtaining the shelters and making them ready, but also planning their use, including: assignment, warning, shelter management, and so on. All civil defense programming is related to, and built on, the shelter base."¹

Provision for shelter management is recognized as integral to building and operating a shelter system. Shelter management is one of the eleven actions designated as emergency operations activities listed in the statement of the National Civil Defense Program submitted during the appropriations hearings of March 15, 1967. This recognition stems, in part, from the fact that most currently available fallout shelter exists in fairly large buildings. Structures having the shielding characteristics necessary to provide reasonable protection generally have the capacity to shelter large numbers of people. As a working premise, it may be assumed that as the size of a shelter population increases, the need for, and importance of, formal organization and trained management also increases.*

*The average capacity of shelters in the National Fallout Shelter Survey is nearly 1000. More than 57 percent of shelter spaces were in 10,430 facilities of 3000 or more capacity; more than 77 percent were in 28,800 facilities of 1000 or more capacity. These 77 percent of all shelter spaces were in 17 percent of all shelter facilities. In cities of 25,000 or more population, 20 percent of shelter facilities had 1000

The National Inventory of Fallout Shelter in existing buildings provides shelter space for 226,706,000 people, with a protection factor of 40, and based on a maximum occupancy of 10 square feet per person. This, on the surface, appears to be sufficient shelter to meet the needs of the population; however, with an assumed warning time of 15 to 20 minutes, it appears that only about one-third to one-half of the population is located so as to be able to use this shelter space.

As a means of locating additional shelter, a Home Fallout Shelter Survey was conducted in the late 1960s in 26 States, which provided DCPA with information about the amount of shelter available in private-home basements. Based on this data and the 1970 Census data, there appear to be about 67,700,000 single residences in the U.S., of which 53.3 percent have basements. About 10 percent of these have a protection factor of 40 or above, and 78 percent have a protection factor of between 20 and 39. This 78 percent could be easily upgraded at moderate cost. In fact, much of this upgrading might be accomplished during crisis periods which might precede a war. If this home-basement shelter space were occupied on the basis of 10 square feet per person, which has been demonstrated to be a feasible occupancy rate, this same fallout shelter space would be more than adequate to shelter the total population. Such an occupancy rate might result in as many as 60 people occupying a typical home-basement shelter. This rate of occupancy would be needed only in areas of severe shelter shortage, such as much of the South and in California. In most areas of

or more spaces, and these 20 percent contained more than 81 percent of the spaces in these cities (as of 1967 when this breakdown was published).¹¹⁵

This point on the greatest importance of the large shelter should not, however, cause us to lose sight of the size of the problem of providing for management of small fallout shelters. There are nearly 100,000 facilities with less than 50 spaces, with a capacity of nearly 2.5 million persons. Nearly 50,000 facilities have a capacity of 50 to 100 spaces. They comprise almost 28 percent of all facilities, although they contain a little over 2 percent of total shelter spaces. Some 37,000 facilities, 24 percent of them, have a capacity of 100 to 200 spaces. Thus, almost 50 percent of all facilities (some 86,000) have a capacity of 50 to 200 spaces. Almost another 100,000 facilities have less than 50-space capacity.

the Country, even under conditions of crisis relocation, an occupancy rate of two or three families in a home shelter would be sufficient.

The private home basement is a major survival resource of the Nation, particularly in the rural or reception areas.*

In relation to high-risk areas, civil preparedness studies have evaluated this home-basement resource from the standpoint of the protection it provides against the effects of blast, heat, and fallout; its location in relation to the distribution of the population; and the degree to which it supports strategies of crisis relocation of populations from high-risk areas and the sheltering of the population without movement.

Shelter protection against the effects of blast and heat effects of nuclear weapons is a different problem from protection from fallout. In blast protection, the most important factor is how the structure responds to overpressures and finally fails. In fallout protection, the most important factors are: distance from the source of fallout radiation and the amount of mass or thickness and density of materials between the survivor and the source of radiation.

Studies of the best-available shelter in high-risk areas which might experience blast and heat effects, rate the single-family, below-ground shelter as providing better protection than most public fallout shelters. The best-available blast shelter is, of course, subway stations, tunnels, mines, and caves, followed by basements and sub-basements of large masonry buildings. Below-ground basement space in wood-framed or brick-veneer structures, including single-family residences, is the next-best protection. In terms of the amount of space available, this is a significant shelter resource in high-risk areas.

* The all-risk, all-hazard approach to civil preparedness planning of the 1970s assumes the use of the best-available blast shelter in high-risk areas in an in-place posture of preparedness and an option of relocation of risk-area populations to reception areas if the nature of the crisis period preceding a war allows for such a strategy.

The protection from fallout varies from structure to structure. However, as a generalization, home shelter provides less protection than public fallout shelters in large buildings; but, because of its location, it is more accessible to the population and, therefore, the only shelter available to some people.

If a nuclear attack should follow a period of crisis relocation, it would be necessary to maximize the use of all available shelter; and, if it were possible to plan to use the best available home shelters and undertake measures to improve their protection during a crisis period, it would significantly enhance survival capabilities.

In order to assess public willingness to share this space with friends or strangers, public attitude studies were conducted during the National Home Fallout Survey, the release of Community Fallout Shelter Plans, and the updating of such plans. These public attitude studies have documented the willingness to share this basement space during an emergency. In various studies representing a large sample of respondents, from two-thirds to nine-tenths of the public say they would cooperate with such plans.

In addition to attitude data, studies of public response to natural disasters further document the altruistic nature of the American people who generally uphold the value that those in need or danger should be protected and cared for. In most disasters, the evacuated population is cared for by friends, relatives, and strangers.

The problems of management and use of this private-home-shelter resource has not been given the same research attention as the studies of large public shelters. This paper will, therefore, outline the current technical bases for the management of large public shelters and evaluate the degree to which the current knowledge fulfills the perceived need for information on shelter behavior and management. Needs and possibilities for further research will be discussed as well as the ways in which results of completed and current research could be applied. It also has secondary aims. One is use as a basis for future consultative panel reviews of the applicability, validity, and adequacy of the techniques, findings, conclusions, and recommendations of completed research; and of plans for future

research. Another aim of this paper is its use in shelter system analysis, as an aid to the integration of behavioral and management factors of shelter operations into DCPA research and operational programs and activities. It will also serve as a basis for the orientation that any new contractors in shelter management research will require. Continuous updating is planned.

1.2 Background

The importance of the human factors involved in an extensive shelter program were early recognized. The Office of Civil and Defense Mobilization started research on these factors in 1958 to help resolve questions of shelter design and feasibility of shelter living. No one was certain about appropriate shelter habitability criteria and what would have to be planned for as an absolute minimum. On the crucial design and cost factor of essential per capita space allotment, for example, recommendations ranged up to 30 sq ft per person. Some of the early questions were: How crowded could shelters be and still fulfill their purpose? What furnishings, equipment, and provisions would be required? How economical and austere could these be? Under what habitability conditions would people refuse to enter shelters, or refuse to remain in them for the duration necessary? What environmental, psychological, and social conditions were essential to assure that people would leave shelters with the health and morale needed to tackle reconstruction? Regardless of feasibility, what standards of austerity would the public reject or be willing to accept --and legislatures support? What level of economy would consequently in the long run most effectively further the objectives of the shelter program?

It may seem surprising that ready answers to at least some of these questions were not available, considering that air raid shelters were not a new idea and that extensive World War II experience existed. Further, there were other related situations, such as isolated polar stations, prison camps, submarines, and the like, that might provide insight and guidance. One of the earliest studies undertaken on behalf of OCDM was a literature survey of experience related to shelter living, conducted through the National Academy of Sciences-National Research Council.²

The NAS-NRC literature study concluded that the historical and related experience surveyed was derived from conditions sufficiently different from those expected in fallout shelters to preclude direct application. The limitations were summarized in an OCDM staff paper of November 1958. The unique qualities of the fallout shelter situation were thought to include:

- "(1) The duration of shelter living, which is considerably longer than that experienced during World War II bombing attacks and longer than the very brief period of time involved in most laboratory research with groups;
- "(2) The large number of persons who might share the shelter, which differentiates this situation from many studies and accounts of individuals under frustrating, deprived, and isolated conditions;
- "(3) The diversity of the shelter population, which distinguishes this from the many military situations which might otherwise have similar qualities;
- "(4) The nature of the destructive agent (radioactive fallout) which differs considerably in the extent to which it can be perceived, uncertainty of the distribution and the duration of the danger, and, in comparison with most disasters, in the actual length of the danger period;
- "(5) The relatively passive adaptation required by shelterees as opposed to the high level of activity required for adaptation in many emergency situations;
- "(6) The devastation of the whole society as opposed to the small segment which is involved in even the largest³ previous disasters of which studies have been made."

Views of this sort and the pressure of shelter design questions and program planning needs led to experimental studies of shelter living. The feeling that expectation of confinement of general populations in fallout shelters for as long as weeks was a unique human situation also prompted the popular question, asked seriously by some, as to whether Americans could live in an isolated shelter for a two-week period under any circumstances.

As a result, the earliest human occupancy tests were as much demonstrations of the basic capacity to remain sheltered for two weeks as they were experiments in the human factors of shelter living. These early approaches to problems of habitability and management in shelters included a single-family occupancy study (Project Hideaway)⁴ at Princeton University in 1959, 100-person tests^{5,6,7} at the U.S. Naval Radiological Defense Laboratory in 1959 and 1960, and a series of 30-person tests^{8,9} at the American Institutes for Research in 1960. These initial demonstrations laid to rest the popular question of the feasibility of shelter occupancy. Vernon, who conducted the first study, reported:

"First and foremost, Project Hideaway demonstrated that a particular five-member family was capable of easily withstanding 14 days of confinement in a simulated fallout shelter."⁴

The group-shelter studies that followed reached similar conclusions. These pilot efforts left much to be desired as conclusive experiments but, as shelter-living experiences, they had a great influence on many questions relating to shelter habitability and behavior. There were strong indications that behavioral problems would not be such as to preclude continued occupancy of community shelters if reasonable provisions for necessities were made.

Space allocations of 8 to 10 sq ft per person in shelters equipped with tiered bunks appeared reasonable. It seemed that the type and amount of furnishings, equipment, and supplies provided, which were considered to be minimum essentials and which had appeared beforehand to be near the probable limit of austerity, were not too austere after all. At least, no volunteer left these early tests because he found discomforts of shelter-living intolerable.* Finally, these experiences signalled the probable high value of trained leadership and proper organization in community

*NOTE: Early tests screened out about 75 percent of the volunteers for psychological and physiological reasons before the tests began.

fallout shelters. It was difficult to avoid the conclusion that a high level of shelter management capability could dominate the outcome of a shelter occupancy test, making a success of austere and primitive conditions that under other circumstances would lead to chaos and failure.

The findings of the first occupancy studies thus led away from the original emphasis on the possible effect of behavioral problems on the feasibility of shelter occupancy to the larger question of the requirements for optimal preparations for effective operation of a national shelter system. "Shelter management" displaced "shelter habitability" as the focus of human factors research. Implementation of a fallout shelter program in 1961, coincident with the transfer of responsibility for civil defense to the Department of Defense, traded on the experience described above, most notably in the definition of a level of austerity for shelter supplies, equipment, and furnishings more severe than those having been shown to be adequate.

In turn, this generated a new series of human occupancy tests initially concerned with validating the feasibility of the current shelter stocking concepts. Concurrently, the later research has explored the associated management problems arising from the increased deprivations of shelter living and the greater complexity and criticality imposed on the performance of necessary shelter functions under severely austere provisioning. Wastage of water, for example, is of little concern if bounteous supply exists, as is the case nearly everywhere under everyday circumstances. But, in a fallout shelter with a sharply restricted supply of drinking water, every drop must be meted out with care. The inadvertent spillage of a water drum is a potential catastrophe. Another example concerns availability of ventilation, a vital necessity people take for granted. It is contrary to daily experience and habit to perceive it as a serious problem that must be understood and acted on--and quickly. Yet, under conditions of shelter occupancy, ventilation may often involve life and death problems that would require immediate management recognition, knowledge of necessary measures, and effective action within minutes or hours. Requirements for sleep impose another set of difficult management problems

under shelter conditions. Without equipment or furnishings, management can even, at its best, be expected to achieve only partial and relative effectiveness in providing space and other conditions for sleep. So, each step toward increasing austerity places greater demands on shelter organization and leadership, careful procedures based on knowledge, and individual and group discipline. A major operational question that emerged is: What is the best allocation of emphasis and funds among the competing demands for furnishings, supplies, equipment, organization, and recruitment and training of shelter managers and core staffs, to assure a workable and economical shelter system?

Other operational questions of increasing importance developed: What special functions, organization, and experience and training requirements of top shelter management are likely to be important to effective shelter operation in large marked and stocked shelters? What are likely to be the special management requirements of very large shelters? What are likely to be the most effective ways of dealing with the identified problems of very large shelters? To what extent can handbooks and other guidance material stocked in shelters be expected to substitute for trained leadership, or support such leadership as may exist? What are the best methods of recruiting and selecting shelter managers and core staffs? What factors must be considered in using as shelters, areas in existing facilities serving peacetime functions? How can training and guidance materials relate to general problems common to many shelter situations, and also prove useful in the development of specialized procedures necessary to fit the specific operational characteristics of individual shelters, especially large ones?

This brief background suggests the importance and scope of the management problems inherent in building and operating a viable fallout shelter system for the protection of the general public in event of nuclear attack. Human factors play an intimate and inseparable role in such a system. There is a subtle and often-ignored tradeoff between "hardware" --the physical facilities, equipment, and supplies provided--and "software" --the planning, organization, recruitment and training necessary to use

the hardware successfully--that must be understood if a feasible low-cost civil defense program is to become real. Specialized behavioral research has contributed and can continue to contribute to this understanding as well as lead to specific preferred solutions to problems.

The fundamental operational goals of a fallout shelter program depend on human factors. People will have to: (1) want and know how to go to shelters on warning; (2) stay in them until it is safe to leave; (3) survive in the shelters; and (4) emerge in good enough physical and mental condition to cope with an austere environment and participate with high morale in the reconstruction and recovery of the Nation.

If the foregoing description of human actions is an adequate statement of the operational objectives of the fallout shelter system, then there is an operational requirement for a shelter organization and management system that will permit this objective to be achieved as effectively and as economically as possible.

II. TECHNICAL REQUIREMENTS

2.1 Research Requirements

As brought out in the Introduction, the operational goals of the fallout shelter system, or any shelter system, for that matter, are contingent on human characteristics and human behavior. For the system to fulfill its mission, people must want to enter shelters on warning and know how to get to them, must want to remain in the shelters until it is appropriate to leave, and must not only survive the sheltered period but emerge with high morale, in physical and mental condition to survive and contribute to recovery in the postattack world. In other words, the shelter system must be built and operated as a man-machine system. The character of the hardware--the shelters themselves, their equipment and furnishings, and their supplies--must be considered in the light of the characteristics and limitations of the people to be sheltered: their skills and abilities, their physiological demands and responses, and their interacting psychological demands and responses, as conditioned by their knowledge, beliefs, and values. In turn, the behavior of people in the shelter system will be conditioned by the character of the facilities, equipment, furnishings, supplies, organization, management, and quality of leadership provided them.

The shelter system is complex, one of the more complex defense systems we might imagine, not because of the complexity of the hardware involved but rather because of the complexity of the human factors present. It would be possible to reduce concern about this problem under certain circumstances. One probably could create a highly-reliable and effective shelter system if money were no object. Also, one could economize in various ways if effectiveness were not a major consideration. But if, as is the case, the intent is to achieve an effective system at minimum cost, then the demand for knowledge about all parts of the system is at its maximum. Research can contribute in an important way to this knowledge basis.

To discuss the state of knowledge pertaining to the fallout shelter system is a complex task because of the interactions described above. The purpose of this paper is to describe and evaluate the status of knowledge on shelter organization and management as well as the behavioral questions underlying these matters. To do so, however, will necessitate periodic reference to other elements of the system: the facilities, equipment, and supplies, for example. No attempt will be made to evaluate these other elements except in an incidental way. Their evaluation is to be the topic of research state-of-the-art papers on other subjects.

Even with this limitation, the summary and evaluation of the state of knowledge on shelter management is not an easy task because of the many interrelated factors. To permit a useful and orderly approach to this exposition, the subject has been divided into a series of topics and associated questions that need better answers. The topics define areas where knowledge is needed and can be regarded as a listing of research requirements in the area of shelter management. They concern:

2.1.1 Continuous Shelter Occupancy for Extended Periods of Time

Can the American public remain in community shelters for extended periods of time, say, as long as two weeks where necessary? Will the public remain in shelter for as long as necessary? What are the factors in the shelter situation that have a significant effect on the ability to tolerate extended confinement? For example, are there special problems associated with particular sectors of the population, such as infants, children, the elderly, and the ill? And, to what extent are organization and management essential or contributory to tolerance for extended confinement?

2.1.2 Level of Austerity in Supplies and Equipment

What minimum necessities will support extended stay in shelter? How does physical deprivation affect the ability to tolerate shelter living? What supplies, furnishings, or equipment beyond the minimum essentials would have the greatest effect on reducing discomfort or

deprivation and promoting shelter morale and effective use of shelters? What functions must sheltrees perform, and what behavior and responses must they exhibit, as accommodations to the supplies and equipment provided or available? How are requirements for leadership, organization, and management affected by the character of supplies and equipment provided or available?

2.1.3 Physical Limitations of Space, Ventilation, and Other Environmental Factors

What is the minimum practicable allocation of space per sheltree? How is the space allocation affected by the character of supplies, furnishings, and equipment available? What is the relationship between per capita space allocation and ventilation and other environmental characteristics? How does physical arrangement and absolute size of shelters relate to factors of space allocation and environmental stresses? How are requirements for leadership, organization, and management affected by various per capita space allocations and associated environmental factors? What are the implications for shelter management of actual shelter populations greater or less than the numbers planned for in space allocations?

2.1.4 Size and Configuration of Shelter

How are requirements for leadership, organization, and management affected by the absolute size of community shelters? How are they affected by configuration (shape, number of rooms, number of floors, etc) of community shelters? How can various configurations be best adapted to the accomplishment of necessary shelter functions? What is the significance of closely adjacent shelters or shelter areas on shelter management requirements?

2.1.5 Psychological, Emotional, Informational, and Morale Factors

How would behavior and response of sheltrees be modified by the psychological and emotional impact of nuclear attack? To what extent can group association in community shelters be used to alleviate

anticipated psychological distress? What minimum contact and communication with the world outside the shelter appears necessary for psychological and morale reasons? How are anticipated psychological, emotional and morale factors likely to be influenced by mixtures of shelter populations with various demographic characteristics, such as age, sex, socio-economic status, race, education, criminality, and the like? What special problems may result and how may they best be dealt with? How are requirements for leadership, organization, and management affected by psychological, emotional, social, and morale aspects of shelter occupancy? What minimum information and knowledge about shelters and shelter living should be imparted to the public prior to shelter-taking to permit maximum adaptation? When and how?

2.1.6 Operational Procedures for Shelter Management

What special functions, organization, and leadership methods are likely to be most important to effective shelter operation under different conditions? How should various combinations of shelter conditions affect management procedures? e.g., extended shelter occupancy in combination with various levels of austerity of space, supplies, furnishings, and equipment; various sets of conditions involving such factors as physical deprivation affecting sleep and other discomforts, shelter size and configuration, and psychological and sociological factors? What are likely to be the special procedural requirements of very large shelters/? What are the desirable characteristics of shelter leaders and management staffs? What are the preferred methods of recruitment to achieve selection of appropriate qualified people? What experience and training should be imparted to people selected to manage community shelters? Who much, and what kind of shelter management staff participation in preparatory planning and in the maintenance of shelter operational readiness as part of the function of the shelter building system is necessary, desirable, or feasible? What is the simplest format and content of training material for shelter managers? What basic guidance material, if any, should be stocked in shelters? What are the format problems and requirements of guidance

material prepared for use under unfamiliar conditions of stress? What managerial facilities and equipment should be provided? What adaptations in guidance materials, if any, are necessary to meet the needs of untrained leaders as compared with trained ones? To what extent can procedures and organization be standardized to improve the reliability of shelter management and to reduce training requirements? How might a core of trained management expand capabilities through in-shelter training of selected shelterees? How can in-shelter training and information best improve shelter morale and prepare the shelter population for effective post-shelter activities?

2.1.7 Adaptation of Dual-Purpose Space to Shelter Use

How are requirements for leadership, organization, and management affected by the shelter system's predominant reliance upon areas designed and in use for peacetime purposes, rather than upon areas designed specifically as shelters? How can the use of indigenous equipment, furnishings, supplies, and other shelter-area resources to augment and improve stocked supplies and equipment best be assured? What special functions and equipment are needed, firstly, as building system preparations that will facilitate conversion, and, secondly, to carry out actual conversion, during emergency, of dual-purpose facilities to shelter use? Can general guidance and training effectively serve the requirements of greatly different kinds of shelters that vary in such basic determinants as size, configuration, equipment, and other elements critical to shelter preparation and operation? If it can, in what ways might it best be used? Can effective plans and preparations for operation of large shelters be made on the basis of general guidance and training alone, or will technical analysis and consultation that takes into account the physical and human factors specifics of each large facility also be necessary?

2.2 Research Methods and Sources

Knowledge on many of the topics outlined above can be gained in a variety of ways. Some are very difficult to research. A few may

appear to be unresearchable, including those concerned with what would likely happen in event of nuclear attack. It is important to know what research methods and sources of applicable information exist and what the advantages and limitations of these methods and sources are. It is also important to be constantly searching for fresh approaches and new research methods and techniques, especially in those areas where few, if any, useful approaches exist. The search for methods that will increase confidence in the validity of predictions based on them needs to be continuous. In subsequent sections, the status of knowledge on the topics discussed above will be described and evaluated. This knowledge has been acquired by a variety of means, the most important of which are:

2.2.1 Controlled Human Occupancy Experiments

The largest body of data and insight concerning shelter management has come from experiments in which various groups of people have occupied simulated or actual shelters for various periods of time under a variety of conditions in peacetime. This approach offers a number of advantages. Variables contributing to the outcome can be manipulated and controlled to a considerable degree, permitting attention to be focused on the effect of selected, isolable and interacting variables thought to be important. The experimental designs can progress sequentially in relation to problems and findings, and respond to program developments and interests. The characteristics of the shelter environment and those of the shellees can be selected in light of the questions and hypotheses being examined and the research methods and techniques available. Generally, detailed observations and sophisticated environmental measurements and analyses can be made in these "laboratory studies" of shelter living. This approach is fruitful despite recognized limitations. Experimentation is necessarily sharply limited by the fact that the extreme stresses of disaster situations cannot be reproduced. Even physical stresses must stop short of those that can constitute a real threat to the continued existence and health of the subjects involved. As a result, the subjects are always volunteers, self-selected, screened physically and mentally (albeit

superficially in some studies), and fully conscious that the experience is a contrived experiment and not the real thing. No simulation of the real environment of interest can alter these facts. Also, as a practical matter, human occupancy experiments involving considerable numbers of subjects are difficult and costly to perform. There is great pressure to study many variables in the same experiment "to learn as much as possible," with consequent dilution of the knowledge gained on any one aspect. Complex interactions among the variables of importance in shelter living are inherent in this experimental method. So are interactions between the selected variables being studied and influences not being observed. Isolation and rigorous measurement of separate behavioral factors are elusive aims. Extrapolation of findings for predictions and expectations of behavior under real shelter conditions can be useful, though gross.

2.2.2 In-Shelter Training Exercises

A large number of in-shelter experiences occur as part of shelter-manager training courses. Occasional local exercises are also conducted for other purposes. The number of such experiences is increasing each year. These training exercises and "tests" are subject to many more limitations than the controlled experiments. However limited, they do represent a source of data relative to behavioral problems and shelter management that is being systematically collected. Attempts have been made to suggest methods to those who might be interested in adding a research purpose to training exercises that would not unduly interfere with their primary training purpose.

2.2.3 Simulation Methods

The difficulty of gaining knowledge on the management problems of very large shelters, without carrying out numerous very expensive occupancy tests involving a thousand or more subjects, has led to experiments with the applicability of simulation-game techniques. In these experiments, the vast portion of the hypothetical large-shelter situation can be simulated for purposes of study of a great variety of managerial and organizational

conditions and problems. A limited set of factors are likely to be susceptible to this approach, but they appear to be of sufficient importance and the technique appears to be promising enough to merit its use and exploration.

2.2.4 Historical Analogs

Historical analogs, such as World War II shelter experience, are an important source of knowledge. Studies of these sources offer a number of advantages. They incorporate disaster stresses and other stresses beyond the scope of planned experiments. They also incorporate chance factors of location, demographic composition, and social characteristics of the groups affected, beyond the limitations of planned experiments. Human motivations and actions can be analyzed without contamination by experimental biases. Historical analogs permit the study of the interplay of many variables in combination. They have, however, important limitations as well as the advantages mentioned. Numerical extrapolations of findings from reports of situations to those concerned with fallout shelter occupancy are very hazardous: firstly, their recorded data are generally sparse, general, hardly ever reliably quantifiable, and often inconsistent; and, secondly, many important characteristics of the fallout shelter system are not present.

2.2.5 Disaster Analogs

Formal study of shelter-like experiences during or immediately after natural disasters, such as Hurricane Carla and others^{10,11} offers many of the attributes of historical analogs, with some advantages. Portions of the American public are involved, and since data can be gathered during or comparatively soon after the event, they are likely to be more extensive and accurate. Normal procedures for minimizing sources of bias in verbal reconstruction can be employed.

2.2.6 Stress Analogs

The study of the psychological and emotional impact of shelter-taking during nuclear attack, which is likely to involve: the

shattering of normal life patterns and expectations; concern for self and family members; isolation; destruction of privacy; and lack of familiar physical surroundings, interpersonal relationships, and behavior patterns; is a most difficult and important research topic. If the psychological environment under these circumstances can be defined reasonably well, it is possible that analogous situations in real life can be found in which individuals, and perhaps groups, are subjected to a psychologically similar set of stresses. These stress analogs may involve situations seemingly remote from shelter or shelter-like situations.

2.2.7 Systems Analyses

Analytical studies have been a main source of information on shelter management. The kinds of problems to which systems analyses are commonly applied also characterize shelter. The methods of systems analysis have been fruitful in defining and developing such factors as: shelter functions; the relative importance of shelter functions in terms of shelter objectives; interactions among functions; the kinds of skills, activities, teamwork, training and organization required in the performance of shelter functions; timing, in terms of priority of functions and activities, and their sequence during operation; the role of time in determining preparatory, operational, and emergency activities and their interrelationships; organization of the other-than-work activities of sheltrees, etc. These studies have fed into, and in turn had their relevance sharpened by, the occupancy and field studies in the shelter management series. They involved visits to numerous shelter facilities. They incorporate the results of extensive reviews of relevant literature in the fields of psychology, sociology, leadership, organization, management, and civil defense; and searches in a number of other fields that influence the shelter system, such as health, sanitation and ventilation.

2.2.8 Field Studies

Analytical studies combined with field investigations to test the applicability and validity of the analytical findings have been

made. In turn, findings and revisions suggested by and resulting from the tests and additional analytical studies were subjected to further testing and correction. Studies on selection and recruitment of shelter staff, and on planning for group shelters, are among those that have been approached in this way.

2.2.9 Equipment Studies

Direct analytical and experimental studies of the role of equipment, furnishings, and supplies in the shelter system have contributed to knowledge of the shelter management problem. Such factors as equipment needs, operating and maintenance skills, and other requirements, were covered. Occupancy studies are also a source of data on responses of sheltenees to particular equipment, furnishings, and supply elements, including those in the Federal Stocking program; and on the influence of these elements on their life in shelter.

Each of the foregoing research methods or sources has significant value as well as limitations. Many of the methods are complementary. The prosecution of a research program in which all are employed in a coordinated way can go far to compensate for the limitations of each, and to augment and substantiate individual study findings.

III TECHNICAL STATUS SUMMARY

3.1 General

A substantial body of useful information on the topics in Chapter II that "define areas where knowledge is needed and can be regarded as a listing of research requirements in the area of shelter management" has been accumulated. This information is mainly in the form of thousands of statements, in several dozen research reports, useful in building and operating the elements of the shelter system that involve interactions with people. These elements concern control, command, leadership, organization, and social-psychological aspects of population response to the shelter system. The information extends into the components of these elements, such as staff recruitment and training, instructional and guidance materials on shelter operation and shelter living, and information and communication with the population, during both the building and operating phases.

The results of the research in this field are expressed in volumes such as a "Shelter Manager's Guide;"⁶⁵ a training text entitled "Introduction to Shelter Management;"⁶¹ a "Community Fallout Shelter Handbook for Untrained Management;"¹²³ rather than in a form that can be briefly summarized here in graphs and tables, as can findings in other areas of civil defense research. Although the studies contain considerable systematically and experimentally derived data, some in tabular form, an attempt to summarize the thousands of findings into a tabular or matrix form has not been made. This attempt may be a desirable future effort. In a practical sense, the integrating reports just mentioned, such as a shelter manager's guide or training text, perform the task of identifying, summarizing, selecting, and applying the findings of studies that preceded them by incorporating and integrating them. For example, the findings of preceding component

systems studies such as "Manageable Group Sizes in Large Shelters,"⁴⁶ "Planning and Organizing Shelter Non-Operational Activity Programs,"⁴⁷ "The Recruitment, Selection, and Training of Shelter Managers and Core Staffs;"⁴⁸ and of the numerous shelter occupancy studies, are reflected in these integrating products. The experimental, analytical, and integrating studies have had a reciprocal influence on each other, as expected, and show progressive development, evaluation, refinement, and improvement of results. The latest analytical and experimental studies definitely reveal the utilization and benefit of preceding work.

Another important indication of the current technical position--of what we know and do not know--will be used and reflected in Chapter VI of this paper, which will be devoted to presenting operational implications and recommendations based on what we have learned.

A considerable volume of material on the research and findings to date that present results directly, in the form of quotations from selected studies and some summaries of later studies, are included in the Appendices. Descriptions of some studies, along with some marginal notes pointing up and commenting on study content, are also to be found in the Appendices.

For their special interest and illustrative value as indications of the extent, depth, and volume of the research that has been done, and the problems that have been worked on, the rest of this chapter presents some summary statistical tables on occupancy studies and a discussion of austerity factors of shelter occupancy that have had attention in these studies. The austerity features that have characterized occupancy studies are described here because they appear to be germinal and to have a crucial effect on shelter operation and management. The listing indicates and illustrates the status of the approach in one important and complex problem area for which a research requirement was mentioned in Chapter II, and some things we have learned about austerity-factor interrelationships and effects.

3.2 Selected Summary Statistics on Shelter Occupancy Studies

The following 3 tables summarize the number, duration, and population size of studies; the age and sex characteristics of their populations; and the number of man-days of occupancy experienced in the studies reported. The tables show a substantial peak in the number of one-day and two-day studies, with secondary peaks in the number of 14-day and 7-8-day studies. Somewhat more than a third of the studies had 30 to 45 participants. An important number had about 100 occupants. During the last several years, nine studies with 300 to 400, and up to 1000 participants have been performed. All but one of these nine were one-day or two-day studies. The largest study that lasted longer than two days was a 7-day study with 307 persons. Total man-days of occupancy exceed 22,600. Viewed from the duration factor, 14-day and 2-day studies contribute the largest number of man-days of occupancy. From the point of view of the size criterion, 100-person studies accumulated the largest number of man-days; although, when grouped together, studies with 300 or more occupants add up to a greater number of man-days. More than half of the man-days were in studies in which the occupants included men, women, and children.

3.3 Occupancy Experiments--Austerity Characteristics

3.3.1 General

Occupancy studies have in general used variants of two basic levels of provisioning.

Early studies were stocked in relation to several ideas and purposes. They had to be economical. They had to meet what were considered to be special requirements of shelter stocking. Among such special requirements were, for example, foods that had long shelf life, and were not thirst provoking. They could have limited nutritional value since they needed to be relied on for only a short time. Anticipated short-time shelter use was an important consideration.

Another example of special need was in the area of shelter sleeping provisions. It was clearly important from a cost and space-availability point of view to get as many sleeping spaces into a shelter

TABLE 1

SUMMARY OF OCCUPANCY STUDIES,
SHELTEREES, AND MAN DAYS OF OCCUPANCY,
BY STUDY DURATION

Duration of Studies	Number of Studies	Number of Shelterees	Man Days of Occupancy ^(a)
14 Days	10	585	8190
8 Days	1	38	304
7 Days	6	467	3269
6 Days	1	144	864
5 Days	2	145	725
4 Days	2	63	252
3 Days	4	152	456
2 Days	24	3346	6692
1 Day	30	1672	1672
12 Hours	2	494	247
TOTALS		7106	22671

(a) Not adjusted for defections.

TABLE 2
 MAN DAYS OF OCCUPANCY
 BY SHELTER POPULATION CHARACTERISTICS
 AND STUDY DURATION

Duration of Studies	Total	Men, Women, and Children	Men and Women	Men	Children (Two Adults)
14 Days	8190	1750	2240	4200	-
8 Days	304	304	-	-	-
7 Days	3269	1779	-	280	210
6 Days	864	-	864	-	-
5 Days	725	-	-	725	-
4 Days	252	120	-	132	-
3 Days	456	456	-	-	-
2 Days	6692	6364	104	224	-
1 Day	1672	1328	259	85	-
12 Hours	247	52	-	195	-
TOTALS	22634	13153	3467	5841	210

TABLE 3
STUDIES BY POPULATION SIZE AND
MAN DAYS OF OCCUPANCY

Number of Shelterees in Study	Number of Studies	Man Days of Occupancy
4, 5, 6, 7, 8, 10	12	198
15, 16, 18, 19, 20	12	213
21, 23, 24, 25, 26, 27	11	422
30, 34	14	2896
38, 40, 45, 51	13	1680
80	2	2240
99, 100, 10 ⁴	7	5150
144, 160	2	1184
300, 307, 321	3	3391
390, 400, 402	3	1799
504	1	1008
722	1	1444
1046	1	1046
TOTALS	82	22671

as possible. This consideration led to provision for tiered bunks, demountable ones in several instances, so that all available space might be used to the maximum for both day and night activities. The "goes-without-saying" concept of minimum shelter standards in the minds of designers, as well as the objective of maximizing space, led to inclusion of beds in the form of bunk systems in shelters used for the early American occupancy studies and in all German studies. At the time, shelters were largely thought of as structures that were to be built. Inclusion of beds of some kind by designers of shelters that were to be built to house Americans for as long as two weeks came naturally. The thought that beds might be omitted apparently didn't occur to anyone. Another pertinent design idea was used by some shelter designers. It was applied in the Bureau of Yards and Docks and German studies, similarly without apparent or consciously reasoned and expressed basis. This was the taking for granted of shift sleeping, and corresponding provision of bunks for only half of the population for which the shelters were being designed. The importance of the bunk system was recognized through support of an OCD study of possible approaches to a low-cost sleeping system. The study was to examine materials and methods that might be used in developing low-cost demountable tiered bunks that could also serve as seats with backs.²⁹

Other provisions in addition to the food and bedding mentioned above (water, most importantly) were also to be stocked under constraints of economy of cost and space requirements, storage life, and safety.

The two main criteria affecting austerity that were applied in supplying and equipping the first series of shelter occupancy studies were: a judgment of what would be tolerable though not more than minimally sufficient; and an expectation as to what would be feasible and operationally useful in terms of the background of general civil defense concepts and planning current at the time of the studies. The intent was to provide nothing more than austere essentials, as these were perceived and thus defined by shelter designers and experimenters, mainly engineers and psychologists.

Later studies, notably those started at the University of Georgia, used a second, and in many ways different, level of provisioning shelters. The stocking program that had been embarked upon by OCD engendered this shift in the austerity of the shelter conditions in which these occupancy studies were performed. The concept and term "survival supplies," which was being used by OCD to characterize the stocking program, expressed the tone of the extent and level of the shelter stocks that were being purchased. Since this stocking program was being implemented it was important to learn whether a shelter system limited to the Federal stocks being put into shelters--which might in many cases turn out to be their only supplies and equipment--could actually function.

OCD Research had some doubts about whether shellees would complete tests in shelters so austere supplied. But the trials proved feasible and later studies have continued the Georgia austerity level. An important point should be considered in this connection, however. These were the first studies which significant numbers of volunteers left before completion. Possible austerity implications of these defections will be discussed later.

The difference between the austerity levels used in occupancy studies before and after the start of the University of Georgia series are mainly attributable to the number and nature of the items included or omitted from the stocking program. The stocking program includes food and water; toilet sanitation, radiation, and medical kits; and excludes everything else.

3.3.2 Food

All three varieties of stocked food--the biscuit, cracker, and wafer--at different quantity levels, including the carbohydrate supplement, have been tried. Some differences among the tests are outlined in the Tables included in the Appendices. The important morale factor of the presence or absence of hot food, and hot drinks, was a main food difference; as were factors of quantity, variety, and, to some extent, familiarity. There were varieties of furnishings such as tables, and equipment associated

with the preparation and serving of hot food and drink, and other food than OCD rations, that influenced the sense of austerity among the studies.

3.3.3 Water for Drinking and Washing

Water austerity differences relate to two main factors: drinking water, and water for washing and other purposes. It centers on provision of a quart of water per person per day in some of the Georgia studies, as compared with a variety of more generous amounts in the others. It is useful to keep in mind in connection with this limited allowance that a very important factor affecting water need in shelter--temperature--was ruled out as a controlled stress variable in the Georgia studies. Temperatures and humidity conditions were kept optimal. Disliked taste of drinking water because of unfamiliar stocked iodine as a purification agent, stored water, and tepid temperatures, was also an austerity factor in some studies.

Water for washing, a factor of austerity of high importance to shellees in occupancy studies, was generally not provided; though it was available in limited amounts in some of the studies. In studies with high temperatures, the austerity and discomfort associated with lack of water for washing were further intensified.

3.3.4 Sanitation

Differences in sanitation austerity among studies were characterized primarily by the use of flush toilets as against variants of chemical toilets and OCD's stocked commode. Equipment for cleaning, such as brooms and mops, was considered necessary and was supplied in other studies but not in Georgia until recently. The earlier Georgia studies indicated that such equipment was a sanitation, morale, and stress factor, and it was included in the later trials as an austerity variable.

3.3.5 Toilet Privacy

Toilet privacy was somehow arranged in all studies, generally through cubicles built into the shelter facilities used--even though

the certainty of this amenity is not guaranteed by the stocking program. The fact that some provision for toilet privacy always turned up in all studies, including separate toilets for men and women in large studies, may be an insistent commentary on its importance. Its universal provision by the experimenters is the only indication of its weight as an austerity factor in shelters.

3.3.6 Light

Light is another very important feature of shelter studies that was always provided, except for one short experiment with American Institute for Research (AIR) staff members in total darkness. Availability to shellees of life necessities in total darkness could most likely not be assured without people familiar enough with the supplies to handle and distribute them in the dark. Enough light to break total darkness is a shelter survival requirement rather than an austerity factor. Light is not guaranteed under the stocking program. Although none of the studies controlled light as an austerity variable, some allowed the shellees to select their own illumination levels. Since the findings of these studies show clear lighting preferences, they may thus indirectly indicate lighting austerity criteria. Illumination levels selected were a function of specific activities and their locationa, and correlated with noise and activity levels. Generally, shellees selected the maximum level of lighting available during active hours, and reduced it to near minimum during periods of rest or sleep. In all studies, shellees reduced illumination to near minimum during rest and sleep periods. Capability of reducing light to desired low levels was generally easy and thus did not constitute a significant austerity element.

3.3.7 Medical Supplies and Personnel

Medical supplies have varied among the studies. Since the beginning of the University of Georgia series, most have mainly relied on the limited supplies in the stocked medical kits, which are mostly, with several exceptions, first-aid items. The items in the Medical Kit are capable of providing only limited, non-specific treatment of simple complaints

of a healthy population. The experimenters supplemented the stocked medical kits in many of the studies. Not only the nature of the medical supplies but the level of professional qualifications available for their use affected the austerity of medical services provided to the various studies. A number of studies, including some of the Georgia trials, had one or more physicians or nurses, or both, in the shelter during the tests. The physicians generally brought their medical bags as support. Immediate presence of medical personnel in these studies undoubtedly had some differential effect on shelterees' feeling of austerity on the medical score, regardless of their perception of the austerity or adequacy of the contents of the medical kits. In some of the studies, only the stocked kits and standby physicians on call were the provided medical resource. Relevant to the medical austerity of occupancy tests is the fact that all studies called for healthy volunteers. All participants volunteered and, thus in a sense, were self-selected. They were also medically screened, albeit in some studies, especially the later ones, quite superficially. In some studies they were screened more carefully, and in some quite thoroughly--physically, psychologically, and even psychiatrically.

3.3.8 Space - Its Interaction With Absence of Sleeping Provisions, and Management

The absence of sleeping provisions directly increases the influence of space as an austerity factor in shelter. Even though the space allotted per person in some of the Georgia studies was nearly similar to, or even greater than, that provided in other studies, space austerity appeared to have a much more severe effect in the Georgia trials. This was a direct and dramatic result of the absence of tiered bunks, and of sleeping on the floor. The shelter function requiring the greatest amount of floor space without specialized equipment, such as tiered bunks, is sleep. The crowding austerity experienced in the Georgia trials was mainly the result of crowded sleeping conditions. With the amount of floor space available, and the way it was used, few shelterees had enough space to fully stretch out without interfering with, or interference from, another

another person's body. One of the Georgia studies used the austerity factor of reduced space--resulting in the smallest allotment per person of any of the general population trials in terms of sleeping space--and possible ways of mitigating this austerity, as a main variable. Conceivably, with careful and demanding managerial techniques and actions, less sleeping-space austerity might have been achieved through greater efficiency; albeit with much difficulty, if at all. For example, experimentation with modular arrangements in 6-1/2-foot strips; and marked spaces on the floor that took account of differential body sizes of children and others, in addition to ways that were tried, such as putting supplies and belongings outside the shelters, might possibly have resulted in more effective and more equitable use of available floor space for sleeping. It is doubtful, however, that shelter management could achieve administrative and shelteree efficiency and discipline sufficient to affect austerity of space for sleeping.

3.3.9 Absence of Sleeping Provisions--Interaction With Temperature Austerity

Another element directly related to the absence of sleeping facilities and bedding as an austerity factor was the hardness of floor-sleeping, which was started in the Georgia tests. Some relief, even the little obtainable through the use of corrugated fibreboard, seemed essential in Georgia. Carpeting has been used to mitigate floor-sleeping austerity in some studies.

Floor-sleeping, and the absence or presence of blankets and other bedding, also affect temperature-austerity factors.

3.3.10 Personal Sleeping Provisions--Interaction With Space and Psychological Austerity of Others

The last several Georgia studies permitted shelterees to bring what they thought they might need, and many brought sleeping equipment of many varieties. This greatly affected both space and hardness aspects of austerity associated with sleep for those who brought sleeping gear, while it physically and psychologically enhanced the feeling of austerity for those who didn't. In these studies there was space austerity

during floor sleeping even in the shelters that used 10 sq ft per person, as well as in those that used less. Air mattresses, sleeping bags, and other gear preempted more space than bodies of persons without them.

3.3.11 Noise--Interaction With Physical Characteristics of Shelters

Ventilating or air conditioning equipment used in some studies created high noise levels as an austerity factor. In some shelters, discomfort attributed to noise, in large measure noise made by shellees, was a high-ranking discomfort factor. Variations in shelter configurations, such as height of ceiling, degree of enclosure, and hardness of surfaces also affected noise.

3.3.12 Temperature and Ventilation--Interaction With Equipment, Clothing, and Blankets

Temperature, often warmth accompanied by high humidity, and other ventilation conditions, varied as major experimental controls among the shelter occupancy trials and were important factors of austerity for shellees. Many of the studies used heat stress as a major characteristic and variable. Even when optimal conditions were intended by the experimenters, always some shellees were uncomfortable. Ventilation and cooling equipment and its capability, and the effectiveness of its control, varied considerably among the studies. Temperature variations and drafts produced by the ventilating equipment were elements of austerity. General lack of clothing and blankets to permit individual adaptation to environmental conditions enhanced austerity in occupancy studies.

3.3.13 Seating

Sparse or total absence of seating equipment or facilities was an austerity condition in most studies. The presence of tiered bunks influenced seating availability through some direct use for sitting, and through some use of equipment for lying down as an alternate to sitting.

3.3.14 Privacy--Interaction With Bunks and Recreation

Lack of privacy is an austerity factor that is a general concomitant of group shelter living and characterized all occupancy studies. Those tests, however, that had tiered bunks apparently offered more privacy than the others. Some or all of their tiered bunks remained set up during the day, and were used by many for rest and privacy. The privacy, in turn, enhanced reading recreation, and thus affected recreation austerity. Privacy is thus a secondary austerity consideration that was affected by the presence of tiered bunks in those studies that provided them.

3.3.15 Recreation

Availability of reading and other recreational materials varied as an austerity factor among the studies.

3.3.16 Communication

The studies varied in communication equipment, their usage, and need. Need for within-shelter communications capability was more evident in the larger studies, especially in those with multiple rooms and more than one floor. All studies had and used two-way communication capability between the shelter and the outside--between the sheltrees and the experimenters--generally with the understanding that it was to be used as little as possible, for requested information, and for emergencies. Many of the studies also communicated messages to sheltrees, by telephone to the shelter manager or by a speaker system, to help simulate shelter living and for research control purposes. As a result of all this, these studies did not include the effect of the absence of two-way communication, a very important shelter requirement, as an austerity influence. Absence of assured two-way communication in any actual shelter situation would have to be considered an important austerity factor. It would have an additive influence on shelter austerity and its effects.

3.3.17 Expectations and Austerity Levels

Because of strong indications that shelteree expectations of austerity characteristics they would find in shelter had an important influence on their tolerance for shelter conditions, and possibly affected defections from occupancy studies, a study of interactions between levels of expectations and levels of austerity was made.

This study experimentally examined the hypothesis that a person's effectiveness in a public shelter would be influenced by the extent to which his expectations matched what he found--as well as by the actual conditions in the shelter. The behavior and performance of shelterees who expected severely austere shelters, and others who expected less austere shelter living, were studied under shelter conditions of two levels of austerity. Performance of shelterees who expected austere shelter conditions and had their expectations violated was compared with that of shelterees who had similar expectations that were not violated. Similarly, the performance of persons who expected less austere conditions and found an austere shelter was compared with that of persons whose expectations more closely matched the less austere conditions they found. The study showed that shelterees whose expectations about shelter are generally confirmed by what they find will show more initiative and participate more actively in critical shelter activities than will those whose expectations are not confirmed by actual shelter conditions. The study also contributes information on the logical inference that DCPA therefore ought to influence expectations about shelter conditions through public information activities. Efforts at reinforcing attitudes through orientation to shelter living proved to be a complex and difficult undertaking. Further research should precede DCPA attempts to provide such orientation as an operational measure.

IV. EVALUATION OF TECHNICAL POSITION

4.1 General

This chapter will compare research done and products available, as described and presented in Chapter III and in the Appendices, with the research requirements outlined in Chapter II--which in turn were derived from the operational objectives and questions, and from the technical problems engendered by the operational questions listed in Chapters I and II. Several dimensions will be compared. The extent to which the research subjects worked on match those listed will be compared; i.e., how many have been covered--which have been worked on and which haven't--how much remains untouched, and what remains to be done. Depth and adequacy of coverage completed to date will be compared with the nature and complexity of the questions and problems and the adequacy of penetration accomplished; i.e., where have we gone deep enough, and where do we need to go deeper. Adequacy of the definition of the questions and problems, and their implications, along with adequacy of findings as influences on operational questions, objectives, and capability, will be evaluated.

A most important question that must be assessed here concerns the difficulties and uncertainties of research in this area and the limitations on the confidence that should be placed in the operational value of some of its results. More and more frequently we see news reports of speeches at conferences of scientists--especially recently from those of systems analysts--reminding audiences that the closer they get to human behavior and action, the more elusive and difficult research becomes, and the more precarious its conclusions. "One of them, Joseph H. Engel, summarized a three-day forum on 'Systems Analysis and Social Change' by saying: 'As we move closer and closer to human beings, human life, and to its goals, we find that we are dealing progressively with more and more difficult problems.'" (NYT, March 24, 1968, p. 28.)

Although occupancy studies are called "experiments," and they are in many essential experimental studies, they are not of a rigorous kind. Their results, like some data even in what we think of as the more solid field of psychology--when one asks for answers to operational questions--are not "coherent, inter-comparable data which has been systematically gathered in a way which permits interrelationships to be identified and quantified."¹¹⁶ In one of the beginning studies, in 2060, awareness of the limitations of occupancy studies was carefully presented.⁸ Some of the points made have been mentioned in this paper, and the entire statement of limitations is included in the Appendices.⁸ There are, in addition, some correlative observations. Not only are the shelteree groups not strictly comparable; the quality, way of functioning, and effectiveness of the shelter managers and their staffs differ and affect the results. Real shelter managers, in each shelter situation, can also be expected to differ in methods and effectiveness. Effects of participation in an experiment; and of the attitudes, expectations, and actions of the experimenters and observers in different experimental situations; somehow reach, and draw responses from subjects--a subtle contaminating phenomenon little understood but known to be present even in experiments with animals, let alone human beings.

Yet, in spite of all this, there is a strong judgement that the empirical results of occupancy studies offer a great deal that is useful, that they largely represent many essential elements of shelter situations likely to be found in real shelters. The studies create at least some experience with the physical day-to-day life-process aspects of shelter environments and the way people in groups respond to them. Observation of studies is a powerful emotional experience, and this says a great deal. Observers appreciate that they were watching heroes; men, women, and children from the general population who were living through and sustaining heroic stress. The intensity of the stress and its effects were obvious; for many it was the most they had ever experienced. On the basis of the principle used in some research on stress in combat--that the source of the stress doesn't matter, that its effect is essentially the same no

matter what the cause--we can assume, although it is not exact, that our occupancy studies yield some representation of behavioral response to the basic physical, spatial, population, and environmental appearance and characteristics of real shelter.

This field of research, therefore, offers the possibility of evaluating and deciding the cost-effectiveness of many operational aspects of shelter and its goals that involve vast amounts of money and effort. Questions dealing with feasible options on the range of austerity of space allotment per person, shelter life-support stocking and provisioning, and extent of designation and preparation of shelter management, are main cost factors in the shelter system. The potential for pay-off of shelter behavioral and management research expenditure is therefore great. It is at the center of both money-saving and objectives-attainment factors that affect a large ratio of the cost of a shelter system. An example of trade-off costs and feasibility to be determined might be the relationships between smaller space allocations and provision of added equipment and stocks. Another example would be a factor if there were plans for population relocation in crisis periods. Organized commuting to shelter may affect response to shelter austerity and requirements for provisioning standards. It would also, however, eliminate the possibility of a problem resulting from a dichotomy between expected shelter standards and actual conditions, a potential source of difficulty, should it exist.

We need, however, to be cautious about the limitations and the possible synergistic psychological effects of unknown and unpresent factors, and to keep trying to close the gap. We need to keep improving the validity of our shelter simulations as we continually learn more about what shelter conditions might be like, and to keep up with the way changes in the shelter system might affect research on shelter management. Improvement of techniques, and increased confidence in the results based on them, have been and must remain important continuing objectives in this research area.

As the framework for discussion of comparisons between research done (and evaluations of its adequacy) and remaining needs, identical topics listed in Chapter II, as headings for questions indicating areas in which

knowledge is needed and research required, will be used as captions in the rest of this chapter.

4.2 Continuous Shelter Occupancy for Extended Periods of Time

The summary statistics on occupancy studies in Chapter III show that duration is one of the factors that has received considerable coverage. Ten of 73 studies, and more than a third of man-days of occupancy, are represented by 14-day studies. Although duration can be expected to add to the stress of shelter living, it has not been shown to be a critical factor, one that might alone prevent people from remaining in shelter for as long as necessary--so long as reasonable management, space, ventilation, temperature, sanitation, medical aid, light, conditions for sleep, and sustenance are provided. Where shelter conditions are tolerable, duration appears to have no special synergistic effect on shelter conditions or tolerance for them. The effects of and response to duration are apparently determined and characterized by other basic shelter conditions. True, defections from studies, where they occurred, were additive with time, but duration did not appear to become a disproportionate factor in the causative stress or tolerance for it. Research on the specific factor of the effect of extended duration in shelter on weaker groups of the population, such as infants and ill persons (children and aged were included in some 14-day studies), has not been done. Indications are, however, that shelter conditions would not cause the factor of duration, of itself, to have a special synergistic effect different from that which could be extrapolated by qualified persons on the basis of what is known about the influence of duration of stresses or illnesses under similar kinds of conditions. We therefore see no operationally useful results to be obtained from additional shelter occupancy studies of extended duration. Recent experiments, consistent with this opinion, have centered on two-day studies. There are also no special reasons for expecting duration to have a different synergistic character in real shelters than in simulated shelters. There is therefore no reason on this score to study duration differently from other shelter factors. Finally, it does not appear worthwhile to attempt special efforts to increase

confidence in the validity of findings about the effects of duration of stay under simulated shelter conditions. Such efforts need not be separate and beyond those devoted to other findings for the purpose of improving the research basis for operational decisions on building and operating the shelter and shelter management systems.

4.3 Level of Austerity in Supplies and Equipment

This has been found to be a subject with important operational effects. It is central to some of the derivative operational questions asked in Chapter I as well as to the more specific questions listed under the identical topic heading in Chapter II. The work done on this subject was singled out for detailed description in Chapter III. Every question under this topic-heading in Chapter II has had attention. Work on this subject has produced paydirt, but it is complex. There are gross pieces of paydirt, that bespeak meaning, but they have to be further increased, defined, analyzed, and refined. There is probably considerable operational significance in the basic finding that although we had had practically no defections from any studies that preceded those that represent the austerity of current stocking standards, defections appeared immediately when they were instituted, and have continued, from some studies at the rate of about 15 percent. Yet from several of the recent studies there were none or almost none. Defections are an apparently and obviously significant measure of the effects of austerity; but there may be others, and we should try to find and use them. The meaning of defections for whatever it may be worth, e.g., the real reasons for them, and their relationship to austerity factors, is very difficult to extract and validate. The possible effect of expectations in relation to austerity conditions, and, in turn, of their interaction on the occurrence of defections, for example, are worth getting at. Add to this the complex question of the possible relationship between defections from occupancy studies and tolerance for real shelter conditions. The result is an illustration of a complex requirement for research that will add depth and validity to our information on the possible effects of austerity factors in planning for and operating

shelters under emergency conditions. This information and confidence in it would be important to operational questions on allocation of funds affecting and shifting components and levels of austerity in shelter. The many items described in the Chapter III section on austerity characteristics used in occupancy studies indicate the wide range of choices that may be involved. Research in this area can have an important influence on operational choices critical to public attitudes toward building the shelter system; to the effectiveness of public response to shelter conditions in the event of an emergency requiring shelter operations; and thus to the achievement of goals of the shelter system.

4.4 Physical Limitations of Space, Ventilation, and Other Environmental Factors

This is another obviously important topic that has had considerable research attention. A number of studies have been primarily and specifically devoted to the whole of the topic as it stands; and some to one or more components of it. Practically every study included one or more of the factors in the heading, either directly or indirectly, as elements of investigation--especially space. Space is so basic an operational factor of shelters that some element of its effect was a characteristic of all study plans and investigations. These factors were active elements of shelter management studies from the beginning, and are still going strong. Every question included under the topic in Chapter II has had attention.

The studies have developed in complexity and depth by building upon past studies and findings; by investigating and trying additional and new operational equipment and management methods. Recognition of different combinations and interrelationships among the problems associated with the items in this topic has been developmental, a result of increasing complexity and depth of a progression of studies.

Space required is a crucial and pivotal operational question. Space obviously affects cost and availability of a fundamental element of shelter. It interacts directly with other cost and adequacy factors of

shelter. It interacts directly with other cost and adequacy factors of shelter. Although many studies have been done, even one that emphasized reduced space as a subject of inquiry, that experimented with greater over-crowding than had been tried in any other occupancy study, findings about the space factor of shelter are insufficient for operational use. The effects of space as a variable has been too intricately intertwined with too many other variables, the effects of which are also intertwined and intricate, to justify confidence in any findings on space that we have to date. Space, sleep, bunks, absence or presence of some kind of floor-covering, ventilation, management quality, management discipline and capability to be expected under actual conditions, public expectations about shelter conditions, defections, and morale requirements for national recovery and reconstruction, are the least members of the "**bucket of worms**" that need better definition, weighting, and analysis before their operational effects, singly and in interaction, can be evaluated for cost and effectiveness determinations about shelter space.

Ventilation and temperature are vital elements of shelter, recognized from the beginning of OCD research, and have had attention in accordance with their importance. Efforts along the line of equipment development and tests of its use and management implications among populations of shelter occupancy studies have been carried out. Problems and limitations of equipment developed to date and of its deployment by sheltrees, along with a number of associated problems, have been amply demonstrated. Continued development of shelter equipment and related human factors such as instructions and training in its use, and continued investigation of equipment effectiveness during trials with sheltrees is necessary.

4.5 Size and Configurations of Shelter

We have done research on the first two of the questions listed under this topic in Chapter II. They were main subjects of inquiry of several studies. The third question has received only indirect and rudimentary attention, and no work has been done on the fourth question.

The experimental work that has been done is not much more than a beginning. The analytical results, from the study on manageable group sizes, for example, far transcend in extent the experimentally derived findings and recommendations on organization and management of large complex shelters. Since occupancy studies with large populations have been limited, the extent, depth, and validity of experimental sources for operationally useful data on this topic are also so far quite limited; both in number of studies done and in their population size. The largest occupancy study conducted to date included about a thousand persons (in a limited exercise of one-day duration)--there are many shelters of much larger capacity, and in a great variety of configurations that would affect their organization and management requirements. More information on the operational implications of the root characteristics of size and configuration of large shelter; on leadership, organization, function, effectiveness of performance; is needed. For example, guidance products useful in the development of training material and stockable management guidance, based on sufficiently valid research experience and trials in existing large shelter facilities of various configurations, are not now available. A beginning guidance document has been produced, in the form of a prototype handbook for untrained management, at the University of Georgia. The need for such guidance material is important, since, as pointed out in Chapter I, more than half of shelter spaces are in facilities of 3,000 or more capacity, and more than three-quarters are in facilities of 1,000 or more capacity. Though the need is great, production of experimentally derived guidance, well validated, is very difficult. Large population studies are costly, and impose confusions on research design, data collection, and results. Validity problems that stem from complex, highly organized, time-consuming, and contrived processes of collecting, entering, and observing as many as 1,000 (or even 400) volunteers in simulated shelters may be compounded in large studies. The usual worrisome validity gap that characterizes smaller occupancy studies--"this is not the real thing" and therefore cannot produce and reflect behavior "as she will be" in a real shelter situation--looks even more worrisome in large ones. The possible synergistic effects

that the addition of stresses caused by attack might have on the behavioral and management effects of the stresses brought on by shelter confinement and conditions per se are a second reason for concern about validity. Although these effects may not be different, or more difficult to get at from studies of complex shelters than from studies of smaller ones, the weight to be given the possibility and nature of such effects is a validity factor to be considered in using operationally the results of studies of management of both large and small shelters.

The importance and difficulty of the problem of management of large complex shelters warrant several research approaches. The following ideas may be feasible and useful.

It is possible that the configurations of large shelters exist in basic patterns that can be classified into something like a half-dozen-to-a-dozen size and configuration categories. It may also be possible to relate these physical size and configuration categories to types and patterns of expected and planned population size, use, and occupant organizational structure and facility control. It may be further possible that even in combination a reasonable number of categories with distinct basic characteristics and effects on shelter management requirements--along with the different approaches to building and operating the shelter organization and management system that are needed to meet each set of requirements --can be found. If so, it may be feasible to prepare guidance to fit the basic patterns of planning and operations needed for each of the categories. Through a combination of analytic preparation and field work with carefully selected examples of shelter configurations, it may be possible to define appropriate classes of configurations and to produce a reasonable number of guidance documents, one for each category, in the form of model examples; for use in adapting and developing planning, training, and stocked operational guidance documents to fit specific shelter configuration and use situations.

If their production proves feasible, it may also be possible and desirable to use these model guidance documents as a basic and major training tool. Training in large shelter management might consist primarily of

the process of selecting, adapting, and developing the appropriate category of model-guidance-example into specific planning, training, and stocked operational-guidance-for-use-in-emergency documents for individual shelters. Shelter planning exercises have been found to be effective shelter management training vehicles. Such training might therefore have the dual advantage of assisting in both training and in the actual preparation of operational guidance materials for large shelter management. The possibility of research assistance toward such training may be an especially valuable concomitant of the categories-of-models approach, since a promising way of training large-shelter managers has been a baffling problem.

The contingency-simulation-game study and its products offer still another approach to operational questions engendered by size and configuration characteristics of shelters.

Questions on the significance of closely-adjacent shelters or shelter areas on shelter management requirements, so far untouched, should receive attention, definition, and some response during the development and execution of research mentioned above under this caption.

4.6 Psychological, Emotional, Informational, and Morale Factors

The questions under this topic in Chapter II stand at the pinnacle as examples of the difficulty of the problems on which work must be done in order to get operationally useful answers through research. Many of them, to a greater or lesser extent, involve both extrapolation and prediction of behavior--under conditions that are themselves largely unknown, unexperienced, and difficult to describe and predict. But some extrapolating and predicting must nevertheless be done in determining and choosing the critically important human factors to be considered, and the way they are to be dealt with, in building and operating the shelter system; and in making and evidencing cost-effective expenditures of time, money, and effort toward development and improvement of the shelter management system.

All of the questions listed under this caption in Chapter II have been worked on, with useful results. Information on these questions

can profoundly influence determination of requirements for an effective shelter system, and of measures essential to achievement of its ultimate goals. Beginnings have been made upon which more inclusive, definitive, and more precisely applicable data on behavior and morale--data more manipulatable for purposes of operational-decision-weighing-and-making--can and should be built up. Additional information on some of the questions, applicable to larger and more varied shelter situations, for example, is needed.

Research that continually increases validity of the data we have, and confidence in its reliability, is possible, has proved fruitful, and is necessary. Continued effort directed at increasing validity and confidence of the findings in this area, through methodological research devoted primarily and specifically to problems of research design and techniques, is an important available channel for improving results.

A study on public information requisites of a shelter system contributed operationally useful findings and recommendations on the information question. A study on the way behavior is affected as a result of the interaction caused by differences between people's expectations about shelter conditions, and what they find them to be, should contribute further to operational evaluations and decisions on DCPA public information materials and actions that can influence shelter-taking and shelter-living. It is an illustration of research-derived data that can offer answers to such questions as what public information about shelters is needed, and when and how it might most effectively be imparted. Additional research on the subject does not appear to be necessary unless the questions about public information that might affect people's response to shelter-taking and shelter-living change.

4.7 Operational Procedures for Shelter Management

This caption heads the longest series of questions of any in Chapter II. Research has been done on almost all of them. Occupancy and analytical studies were devoted to answering these questions, with a considerable number of directly applicable and immediately useful products.

The enormous body of general knowledge from business, industry, and government about principles of organization, management, and leadership, has been drawn upon. In addition the gamut of subjects on administration and operation that stem from these principles--as represented by the questions--has been related and specifically applied, in substantial and practical detail, to the special goals, functions, population conditions, skills, leadership requirements, problems, environmental situations, etc., all in their great variety, that are uniquely expected to characterize shelters and shelter behavior.

On some of the questions the products can be considered adequate answers, on which no additional research will be needed. The problems have been adequately defined in terms of current operational needs, and research findings and recommendations are considered to be a sufficient basis for operational decisions and the preparation of DCPA guidance concerning them. On methods of recruitment and selection of shelter managers and staff, and on some aspects of training, some directly useful prototype products have been produced, some of which have been put to direct application. One has been published by DCPA as a training text on shelter management, essentially as produced.

Some of the questions worked on require continuing effort: to broaden and extend, and also to deepen the findings, to cover situations and combinations of factors not yet examined; e.g., the question about the way various combinations of shelter situations should affect management procedures. As in relation to other topics and questions, research to improve validity of and confidence in the findings, and in the conclusions drawn from them, need continuing improvement. On some questions only a beginning investigation has been made. Several have not been worked on at all, and will require some research effort. The question on managerial facilities and equipment required has not been touched. Possible research approaches mentioned under previous captions would also provide opportunities for operationally useful data on questions under this caption. For example, the investigation of the feasibility of using non-DCPA-sponsored exercises for research purposes may result in a promising resource.

Questions under this caption should also be enlightened by studies aimed at producing categories of model plans, if these prove feasible and valuable; and by contingency-game-simulation studies.

4.8 Adaptation of Dual-Purpose Space to Shelter Use

Most of the questions under this caption in Chapter II have been worked on in an elementary way. Enough has been done to produce a practical and immediately useful prototype guidance volume that deals mainly with dual-purpose shelter, one of a set of four volumes, consisting of the following: "Shelter Manager's Guide/Guidance for In-Shelter Use;" "Introduction to Shelter Management/A Training Text;" "The Selection and Recruitment of Shelter Managers;" and "Planning A Group Shelter/A Planning Guide." The questions transcend the material in the Planning Guide, mainly by emphasizing problems concerning methods of implementation. Since implementation largely remains to be accomplished, research affecting implementation can be operationally relevant and useful. Additional technical information can be operationally relevant and useful. Additional technical information beyond the guidance in the Planning Guide may also be useful. For the near future, however, the research to be produced in response to the needs mentioned under the preceding captions should also provide data useful under this topic, and direct separate investigation on it should not be necessary.

V. FUTURE PROGRAM EMPHASIS

The following is a tabular listing of research tasks that might be undertaken during the next five years, derived from research needs indicated in Chapter IV. Priorities, levels of effort in duration and money, alternative levels, and respective cost estimates, are shown. Summary cost estimates per year and for 5 years, by priority and level, are also included. Time factors, as well as importance, determine priority. Delay will have a compensatory advantage for some tasks. It will result in availability of usable findings from related studies completed during the delay. Also, the results of studies in some areas are likely to prove useful sooner than others in relation to DCPA operational developments.

Research Tasks Needed During Next 5 Years	Priority	Duration in Years	Duration in Years		Level of Effort/Yr		Cost for 5 Years	
			"A"	"B"	"A"	"B"	"A"	"B"
			Level of Effort	Level of Effort	Level (in \$ thousands)			
1. Experimental Studies to Improve Research Methodology and Validity of Findings	I	5	5	5	120	80	600	400
2. Model Individual Shelter Plans	I	5	5	5	160	80	800	400
3. Model Operation Guidance and Training Documents for Categories of Large Shelter	I	3-5	3	5	80	40	240	200
4. Contingency-Simulation Game	I	5	5	5	80	40	400	200
5. Stockable Management Guidance	III	3-5	3	5	40	20	120	100
6. Improved Definitions, in Isolation and Interaction, of Operational Problems and Possibilities Associated with Shelter Space Allocations	II	5	5	5	120	80	600	400
7. Operational Implications of Defections	I	5	5	5	120	80	600	400
8. Psychological and Morale Factors in Shelter Operation and Management	II	5	5	5	120	80	600	400
9. Effects of Various Kinds and Levels of Austerities	II	5	5	5	160	120	800	600
10. Public Information and the Shelter System	III	2	2	2	80	40	160	80

(continued)

(continuation)

Research Tasks Needed During Next 5 Years	Priority Years	Duration in Years	Duration in Years		Level of Effort/Yr "A" Level Effort	Level of Effort/Yr "B" Level (in \$ thousands)	Cost for 5 Years "A" Level (in \$ thousands)
			"A"	"B"			
11. New Shelter Ventilating and Other Equipment and Its Human Factors Inter- actions	II	5	5	5	160	120	800
12. Occupancy Studies to Update Simulations to Match Anticipated Changes in Actual Shel- ter Characteristics	III	2	2	2	120	80	240

SUMMARY

Priority	Total Cost Per Year		Total Cost for 5 Years	
	"A" Level	"B" Level	"A" Level	"B" Level
	(in \$ thousands)		(in \$ thousands)	
I	560	320	2,640	1,600
II	560	400	2,800	2,000
III	240	140	520	340

Perspective

A valuable perspective on the preceding tabular listing of specific research tasks is provided by the following statement on "Research Needed" that was part of a state-of-the-art paper written in 1961, not long after the shelter habitability research program was started.¹³⁴ As reported in Chapter IV, many of the items in this statement of "research needed" have been worked on; many have not been touched:

"V. RESEARCH NEEDED

- "A. Tests of shelter space allotments that appear to be close to minimum manageable limits, between five and six square feet per person. (The tests would include experimentation with bunk tiering and facilities, special staggered and rotating sleeping schedules, and sleeping and day-room arrangements.)
- "B. Development and tests of a shelter-manager training program, including necessary guidance and training materials.
- "C. Development and test of a program for selecting shelter managers and supporting personnel.
- "D. Ways of identifying techniques for providing situations conducive to adequate sleep in shelters. (This would cover: ways of establishing and maintaining quiet hours; ways of mitigating the problem of maintaining quiet from its importance as a major source of conflict; ways of mitigating as disturbing factors the desire of individuals to retire at different times and get different amounts of sleep. It would also cover the role and effects of the following factors: bunk design; bunk stability; more than three tiers; availability of bunks during waking hours; compartmenting of sleeping space; various sleeping schedules; relationships between sleep and minimum lighting requirements and arrangements, including switching for day and night use; ventilation; and temperature.)
- "E. Determine and test feasibility of multi-purpose bunk designs to fit the numerous unique requirements of shelters - in relation to comparative cost and effectiveness of alternative special equipment designed for separate uses, e.g., sleeping and sitting.

- "F. Tests of capacity and other factors of shelters in which no bunks or bedding is provided.
- "G. Ways of improving habitability of family fallout shelters under varieties of temperature and other conditions, and for varieties of family compositions.
- "H. Tests of preparatory measures and operating and conversion plans for large dual-purpose shelters.
- "I. Development and tests of guides and manuals on shelter living, for shelterees.
- "J. Determination of the relative problems, advantages, and disadvantages--for preattack preparations, emergency occupancy, and possible postattack occupancy--of family and group shelter.
- "K. Tests of ways of most effectively familiarizing the general population with shelter. (Experimenting, for example, with the use of the finding that the feeling of overwhelming crowding among test occupants diminished after an hour or less.)
- "L. Tests of feasibility and ways of familiarizing top national and local leaders in their shelter roles through personal participation in shelter experience.
- "M. Development and tests of the depth of shelter management staff, in addition to the manager, that requires training; and how much, if any.
- "N. Develop requirements of, and maximum feasible preparations for, attack and postattack communications to shelterees.
- "O. Feasibility and desirability of a policy of not locking shelter doors.
- "P. Determination and tests of the possible trade-off between trained managers and guidance material specially prepared for relatively untrained management.
- "Q. Development and tests of feasibility and ways of assigning people to shelters, maintaining currency of assignments, and integrating this function with the rest of the requirements of the shelter management system to achieve maximum utility from it.
- "R. Development and/or test of a plan for the collection and maintenance of the quantitative and qualitative data on the status of the national shelter program that will be adequate to fulfill administrative and Congressional reporting requirements.

- "S. Determine the full-time staff requirements, if any, indispensable to a security, maintenance, and shelter readiness and conversion program.
- "T. Determine the effects on the development of the shelter system of possible requirements for postattack uses.
- "U. Tests of preparations necessary to the development of programs for rehearsals and exercises in shelter taking and operations. They need to cover components of shelter operation, the shelter as a whole, and the total shelter system, including family and community shelter.
- "V. Develop and incorporate tests of foods that may be developed through research on special foods for shelters into habitability studies, as these foods become available.
- "W. Ways of involving and preparing people to deal with information and events, convictions and beliefs, and roles greatly different from anything they have experienced.
- "X. A number of dimensions of shelter habitability have not been experienced, and need adequate empirical test. Social and psychological studies should provide information useful to development of operating techniques--that will maximize management effectiveness, enhance conditions conducive to adequate sleep, and minimize conflicts arising out of differences in social, moral, and ethical values held by shellees. Some of the dimensions that require further study, as recommended by AIR, are: inclusion of hitherto largely untested groups in representative shelter populations, such as: infants and children of pre-school age, mixed races, physically ill or handicapped, psychologically disturbed. Tests with special populations, such as: school children with teachers, hospitalized patients, neighbors both with and without working members of the family, working groups from the same organization, and downtown daytime populations.¹³⁴

VI. RESULTS OF IMMEDIATE OPERATIONAL VALUE

6.1 General

6.1.1 Introduction

In addition to the thousands of findings referred to in the beginning of Chapter III, the studies include hundreds of recommendations. Most are identified as such, in sections categorized as "recommendations," but some are to be found throughout the reports, as logical accompaniments related to discussions of "findings" and "conclusions." For example, there are sections that include recommendations on a range of subjects, about as wide as that covered in the reports, in University of Georgia studies. In one of the HRB-Singer studies there is a chapter on recommendations for shelter managers on behavior under shelter conditions. It deals with recognition of problems and needs, and with remedial measures and concrete aids that could be used to reduce stresses. The chapter is an example of material in the reports on recommendations, like some material on findings, that could be used in producing manuals and handbooks, though it is not now in a form suitable for direct inclusion in such publications.

Like many findings, many recommendations too have been integrated into prototype research products that were needed and prepared during the conduct of the research. They were written in the form of illustrative manuals, handbooks, and textbooks. An example is the research prototype handbook for untrained management, the seventh edition of which accompanied the 1966 report from the University of Georgia. It was produced as a by-product of the process of developing and testing study findings and recommendations. The seventh edition, modified, was again tried, and found not ready for use as a model handbook for use by sheltenees. The University prepared a revised, eighth edition in 1969, after completion

of its two 1967 large-shelter studies, and its work on a synthesis of findings based on large-group occupancy studies.

It was pointed out earlier that a collation of findings is a valuable--perhaps necessary--prelude to the future preparation of manuals and handbooks on shelter operation and management. Similarly, a collection and classifications of recommendations, though there are many fewer than findings, in some tabular or matrix form, is also probably a necessary preliminary.

Of the recommendations mentioned in the studies, a selected number are discussed in this chapter. Some presented here are taken directly from the studies, others are syntheses of both findings and recommendations. They are selected from the point of view of their relationship to current DCPA documents. The recommendations discussed are selected for the purpose of a formal comparison with corresponding content in DCPA issuances. Such comparison should affect DCPA evaluations and determinations of the need for changes and improvements in its operational capabilities, and in its policy and operational guidance and other materials. Further, this comparison should also propose and provide a basis for immediate content revisions and additions to DCPA releases; for changes in policies and in operational planning, practices and actions, including those affecting training, and for changes in shelter provisioning.

6.1.2 Concept

As pointed out earlier, and as is apparent from a reading of this paper, the habitability, behavioral, and management elements of a shelter system are "soft." They are soft for a number of reasons, from a number of points of view, and with a number of practical policy, planning, and operational effects. For example, it is very difficult to provide well-substantiated numbers for use in demonstrating the relationships between shelter management factors of a shelter system and numbers of survivors. It follows that if we have trouble defining and showing these relationships to begin with, we will have difficulty evidencing the dynamics of the mathematical relationships between changes affecting shelter

habitability and management factors, and "survivors added" that might occur as a result of these changes. Not only are these factors numerous; they are complex and difficult to isolate and define as countable elements; and they are complex in interaction.

Because shelter habitability and management factors are soft, and very difficult to influence to boot, it becomes tempting and easy to minimize them in allocating stringently limited DCPA efforts and resources. It may be too tempting and too easy to go too far toward zero effort, and the tendency may need to be recognized, evaluated, and guarded against. Though hard data may not be available, there is considerable indication that levels of effort on shelter management will directly affect levels of attainment of basic shelter system objectives. Too little concern and effort may hazard unwanted consequences. The negative trade-off results may be disproportionately large for the effort saved. Risk of costs in terms of fewer survivors added, suffering, and lower morale--which in turn could reduce recovery effectiveness--may clearly outweigh advantages gained by minimizing expenditures on shelter habitability and management. Allocation of some additional resources to shelter management activities, even in the face of plausible and apparently acceptable minimum efforts, may further shelter objectives more effectively than similar resources applied elsewhere in civil defense.

Several key ideas open this possibility. The first has to do with the criteria used to decide the ultimate objectives of the shelter system, and to measure and evaluate effectiveness and progress toward their attainment.

A root issue, affecting a main civil defense objective, devolves on whether we express the concept of lives saved through use of the term "effective survivors added," or "survivors added," or both. The concept of "effective survivors" adds a social-effects dimension. To some extent, DCPA objectives of shelter must encompass considerations that will influence community, regional, and national viability. These considerations go beyond individual survival, though it does come first, to factors such as the following:

(1) shelter conditions that sustain physical and mental self-care capability. Conditions that are organized and equipped to minimize the number of shelterees who may become medically dependent. Conditions that will minimally reduce the effectiveness of survivors added as a consequence of dependence of casualties or ill persons.

(2) A standard of austerity of shelter living that a minimum number of shelterees will find intolerable--who will defect as a result--and whose defections may thus reduce the number of survivors added.

(3) Shelter habitability and management conditions that can affect the suffering, survivability, or duration of morbidity of casualties that may be found in shelters.

(4) Shelter conditions that determine the effectiveness of the capability of the shelter organization, and its individual shelterees, to function in emergency operations --to serve as a center from which group and individual work, movement, and other local and national protective, reorganizational, and recovery actions may be coordinated or carried out, in accordance with desirable postattack priorities, in the immediate postshelter period. This function requires an additional and more complex information-and-communication, organization, and coordinated-leadership role than that demanded by transattack shelter operations alone. It, thus, requires some kind of a knowledge and belief system and more discipline on the part of the shelterees and shelter management. It requires an acceptance of some organizational continuity beyond the shelter period: of governmental authority and community relationships; of responsibilities, skills, and knowledge as functions of shelter management; and a shelter system role in an emergency operations system that extends beyond that required by the temporal shelter protection function alone. It may require information transmission and discussion sessions during the transattack period in shelters for proper understanding of time-phased exits from shelters, post-shelter hazards and actions that may affect individual survival and effectiveness of group survival, reorganization, and recovery.

(5) Morale. The four factors listed above will affect, and in turn be affected by, morale both in shelters and after exit from shelters. Quality of leadership, as it influences morale, will influence the effectiveness of achievement of shelter objectives in terms of these factors. Morale, tied to the effectiveness of leadership's attainment of group cohesiveness and group goals in shelter, will in some measure continue to characterize the quality of the morale, and thus the effectiveness, with which populations after emergence from shelter will face and cope with the stresses and demands of survival, reorganization, and recovery.

A second key idea is closely related to the one just discussed on criteria that are important to decisions on the ultimate objectives of the shelter system. It derives from basic provisions in the Federal Civil Defense Act of 1950. They are expressed in generic terms in the Act, and have to be clothed with standards and actions by DCPA. These standards have been, and will continue to be, changing ones for many reasons. Nevertheless, DCPA needs a continually updated interpretation and definition of the mission, and of the standard, of shelter habitability and management that it considers necessary to give effect to provisions of the Act--which are expressed as broad and generic standards in terms of the words "minimize" and "adequate." The standards in the Act are stated in broad terms, expressed in the following phrases: "to minimize the effects upon the civilian population," and "measures designed to afford adequate protection of life and property." DCPA is left to define what minimized effects are, and how much protection is adequate protection. These standards should be established and maintained, apart from and as a basis for continual comparison with, definitions of their meaning that are really determined each year by the Congress through the appropriations that give them effect. Much of the material in this paper, though it was not designed with this objective as one of its targets, should be useful in determining these standards. This determination and public understanding of these standards are important to public and Congressional assent to and support of the shelter program. It is quite possible that a shelter program at the extreme of austerity may win less support from Congress and the public than one that is less austere--that negative reaction to an extremely austere prospect may outweigh negative reaction to the greater cost of a less austere shelter habitability system. The possibility may fit an old principle of sales organizations: that the factor of cost is secondary to the desire that has been built up for the product in decisions of buyers. DCPA should thus determine a range of measures that define options and costs, and offer public choices as to the minimal effects desired and the protection that is to be considered adequate.

An example of a concept used by DCPA to give effect to the generically stated standards in the Act is expressed through the term "survival supplies." It is also an example of a concept, term, and an implied standard, that requires clarification by DCPA. This is so because many of the items in the supplies are not really necessary for human survival. Many of the items in the medical and sanitation kits are "minimizers," "mitigators," "amenities." Many are for comfort and for first-aid relief only. To the extent this is so, analysis and development of the concept of "survival supplies," and of the use to be made of the term in the future, is advisable. If the concept is important, its clarification would have implications for possible current inconsistencies in policies and operations, and for plans and actions in the immediate and more distant future. All kinds of differences and implications flow from a mission concerned only with survival or survivors-added, and supporting supplies and activities--as compared with one designed to "minimize effects" and "to afford adequate protection." Although survival comes first, and what is easiest and cheapest in adding survivors comes first, the need, prospective gains, difficulties, sequence of greatest pay-off--and corresponding prospective costs, of steps toward minimization of effects of attack beyond survival--should receive analysis, definition, and DCPA dissemination with recommendations.

A third basic concept to be considered in determining resources to be devoted to shelter habitability, behavior, and management is that of the stockpiling requirement--based on the idea that it is necessary to have some preparations in place in shelters. The determination as to what to stockpile largely relates to habitability standards, behavior, and management, as well as to survival and survivors added. As pointed out earlier, many of the items in shelter stocks cannot affect survival. The concept that there is a critical requirement for stocked preparations pre-positioned in shelters has implications for requirements far beyond the particular items being currently stockpiled. For example, if some items are really that important, then concomitant management factors that may be essential to or critical to effective use of the items are correspondingly

important; e.g., stocked instructions, organizational and training preparations; as well as communication and other equipment. If some items of preparations must be in place in shelters, then we must periodically determine whether we have selected the right ones--that all are needed, and that none needed have been omitted. If the presence or absence of prepositioned stocked items is a clear enough criterion for counting or not counting shelter space availability, then there are management factors critical to the use of the items that are no less countable in determining shelter availability, and in planning and preparations affecting building and operating the shelter system.

6.2 Basic Statements on Shelter Management in DCPA Documents

6.2.1 Program Objectives

Research on shelter management includes behavioral and habitability aspects of shelters. Recommendations derived will be compared against statements on these subjects in DCPA releases. The following statements are from the Federal Civil Defense Guide, Part A, Chapter 2, on the National Civil Defense Program--the part headed "Program Objectives:

- "1. The following are the objectives for each sub-program of the Civil Defense Program . . .
 - a. Protect Life - Protect life and guard the health of the population.
 - (1) National Fallout Shelter System - To provide austere but adequate fallout shelter at the earliest practical time for the total population. This includes actions to: . . .
 - (d) Plan for effective use of the shelters, including trained management staffs."

The above are the basic statements of objectives that encompass shelter habitability and management factors. They are stated in terms that are more positive and inclusive than those that might be called for under objectives and standards associated with the concept and term "survival" alone. The terms "survival" or "survivors added" are not used in the statements.

Recognition of the importance of shelter management was reflected in its inclusion as a Priority 1 item among the four Major Program Emphasis Areas assigned for FY 1969 (Part B, Chapter 3, Appendix 1, March 1970).

In the rest of this chapter, further references to material in DCPA documents, and discussions and recommendations on these releases, will follow generally the order of subject priority indicated by the listing of major program areas used in the 1971 Program Emphasis Paper.

6.2.2 Community Shelter Planning

6.2.2.1 Space-per-Person Criteria

The OCD Guide provides the following:

"guidance on the use of space-per-person criteria of less than 10 square feet in Step I shelter capability allocation plans, in aboveground space only, of PF 40 or more. Final decisions on whether or not to plan for the use of shelters at more than rated capacity will be made at local option, after analysis of the potential thereby available, using the procedures detailed in this annex." (FCDG, Part D, Ch. 3, App. 1, Ann. 6, p 65, December 1965)

The guidance states that research and analysis on the problems "resulting from reducing the space allocated to shelterees" is continuing and the "annex will therefore be revised." The primary considerations discussed relate to problems of heat and humidity, and regional climatic conditions. The guidance recommends

"the use of space-per-person criteria of down to 8 square feet in aboveground space in shelter-deficit areas, except in the crosshatched area shown in Figure 1. Shelter occupancy tests conducted by OCD indicate that occupancy at 8 square feet per person is feasible, although shelter management problems are substantially increased." (p 67)

The results of this continuing research and analysis on the problems of reducing the space allotted to shelterees now indicates the need to revise this recommendation. The above one-sentence reference base, citing findings attributed to occupancy tests, also now needs revision. Occupancy at 8 square feet per person had been established as feasible in shelter

tests that gained sleeping space through the use of 3-tiered bunks. The statement on the possibility of a later recommendation, based on later occupancy research, for further reduction below 8 square feet in space-per-person criteria, through "a revision of this annex," should be rescinded. Reasons for and discussion of these recommendations for changes in the Guidance follow.

In tests without tiered bunks, with floor sleeping, 9 square feet, exclusive of a square foot per person for supply storage, was found to be necessary if sleep was not to be seriously interfered with. Nine square feet per person, which happens also to be an architectural-engineering standard for the size of the human body, is the least that will allow floor sleeping in shelters without interference with or from other person's bodies. It allows for some hit-or-miss interstices, between and around bodies, but not for organized and maintained aisles required for toilet, water, management, communication, radiation monitoring, fire and security patrols, and other functions. Furthermore, nine square feet per person for floor sleeping, effectively used, requires shelteree cooperation and discipline, and management effort and determination that will be difficult to achieve. For example: management will need to organize, locate, and assign each person's sleeping space to take advantage of and allow for children's and individual body-size differences; communicate its objectives and the constraints required on the part of shelterees to win their cooperation and adherence; insist upon shared use of sleeping pads that shelterees might bring because they occupy 12 square feet and thus encroach upon a third of another's space if used by an individual.

Shift sleeping, only in a shelter configuration that allows effective isolation of sleeping areas, can be an alleviating consideration. Shift sleeping at best interferes with sleep in a civilian population. Without adequate isolation for sleeping, an overcrowded situation that would require some persons to be up to make room so that others might lie down to sleep will result in substantial sleep deprivation. Another possible alleviating factor experimented with was the movement of shelter supplies outside shelter areas to add to sleeping space.

Although ventilation conditions should undoubtedly be the primary determinants of space-per-person criteria, habitability and management factors must also be considered in determining these criteria. They should be taken into account, in addition to heat and humidity, in discussing "a space-per-person criterion of as low as 5 square feet per person . . ." (p 66)

Space in shelter--meaning essentially space for sleeping, because sleeping requires more space per person than other shelter activities--is a major and central element in tolerance for and acceptance of shelter conditions. Since the Guidance provides for local option in the use of criteria below 10 square feet per person, it should inform local officials of the consequences and implications that might be involved in the use of the option. Use of the option imposes habitability and management problems and requirements. The guidance should state that use of an inadequately planned-for figure below 9 square feet per person, that does not carefully take into account the configurations, use plans, and other conditions, of individual shelters, may increase shelter habitability and management problems to the point of intolerability for some of the population. The guidance should also make clear that further reduction to the 5- or 4-square-foot-per-person figure mentioned may thus mean no space for sleeping in shelter, and other additive and synergistic organizational management, and habitability stresses that an additional part of the population will find intolerable. People who leave shelters prematurely will reduce the effect of shelter protection on numbers of survivors added and on numbers of injuries avoided.

Habitability and management implications of the following statement should be added to the Guidance: "However, criteria of 5 or 4 square feet will allow shelter occupants to sit down only, not lie down." (p 67)

Efficient assignment of floor sleeping space in shelters accompanied by active shelteree cooperation--a necessity if effective availability of even 9 square feet per person is to be achieved--will probably be rarely if ever attained unless carefully prepared for. (It

was achieved only once in occupancy studies without bunks, probably because of maximally favorable configuration of the shelter, in addition to other special management conditions.) Similarly, effective rotation of shelterees among shelter areas--which will depend upon efficiency and precision of management information, planning, and execution--will also probably be impossible to attain without careful plans fitted to the characteristics of specific shelters, and well-prepared management and shelter populations.

Shelterees in occupancy studies tend to become strongly attached to specific spaces and to strongly resist movement. Some defections were brought on at the point when forced movement, experimentally imposed by the closing of rooms, was added to the other shelter stresses.

Furthermore, individual space-taking, the usual procedure followed in occupancy studies, results in encroachments and inequitable space distribution in shelters without bunks. Without determined preparation, random individual space-taking can be expected during shelter operations. Without determined management control, square-foot-per-person standards will not equate with actual coverage space-per-person availability.

The DCPA guidance should therefore indicate that where space-reduction criteria propose to depend upon rotation of shelterees--or other measures predicated on close-fitting, maximized aims and adaptive actions by shelterees--the criteria cannot be expected to be effectively attained without specific preparations for management capability and shelteree performance that recognizes and takes into account the complexity and requirements of rotation, shift sleeping, and other tight-space-utilization techniques, as shelter measures.

The experience of consistent defections from many occupancy studies indicates that although the population will stay in shelters if reasonable management, space, ventilation, temperature, sanitation, light, and sustenance are provided, some people will not tolerate shelters if these are not provided, and will leave. Provision of severely stressful shelters is inconsistent with the standards and objectives expressed in the statements from the Guide quoted above. Severely stressful shelters are also not likely to sustain the performance and morale required for

effective operations during a trans-attack period and in the immediate post-shelter period. Community Shelter Planning (CSP) Step V plans refer to this period as Phase IV - Shelter Emergence, and include a list of functions to be planned for, beginning with "Post-shelter use of shelters for immediate recovery operations." An important consideration in determining shelter habitability standards is avoidance of stresses that may weaken the resistance of shelterees to conditions conducive to the development and spread of diseases--conditions likely to prevail during the postattack period.¹²¹ A related function would be the need to inform the population while they are in shelters of health and sanitation measures that will be vital to them under postattack conditions--as well as hazard-protection measures.

To repeat, the reference made previously to the possibility of a future recommendation for further reduction in space-per-person criteria below 8 square feet through a future revision of this annex should now be revised; along with the Guide's recommendation for 8 square feet discussed earlier. The material on criteria for the use of 5 or 4 square feet per person, and the two summary paragraphs should also be revised. (FCDG Part D, Ch 3, App 1, Ann 6, pp 65-67, December 1965.)

In connection with the above recommendations, a review of the extent and status of local adoption of lowered space-per-person criteria to date under CSP plans and resulting statistics on the problem may be timely. The effects of the descriptions of options available to local decision to plan for the use of public shelter at more than rated capacity, combined with emphasis on identification of shelter deficits, the needs of shelter-deficit areas, and the finding that in places "population is increasing at a faster rate than the number of community shelters," suggests that it would be useful to analyze the collective results of these influences--if a recent analysis has not been made. (Part D, Ch 3, App 1, pp 16,17,24.) A vehicle for collecting this information was provided as "Figure 2--Estimation of additional space from using aboveground space in existing shelter at less than 10 square-feet-per-person." (Part D, Ch 3, App 1, Ann 6, p 69.) This form includes a column

headed "Additional spaces from use of other than rated capacity." A required DCPA Form issued later, Form 757-1, dated Sept 66, "Community Shelter Plan--Shelter Allocation (Step 1D) Report Form," calls for reporting the use of more than rated capacities. It calls for entries opposite the caption, "Spaces Gained by Reducing Space Allocation." (Chg 1 to Part D, Ch 3, App 2, Ann 4, p 63, Apr 67.)

6.2.2.2 A Space-Saving Measure for Consideration

The above discussion indicates some of the problems involved in developing measures for effectively reducing space-per-person allocations in shelters. A combination of several logical steps that follow from findings of shelter occupancy research yields an untried idea that may be cost-effective in some situations and applications, and may be worth investigating.

The idea leads to the use of tiered sleeping space in a new way. Its use may make available more space for sleeping, per square foot of shelter area, than we have achieved or envisioned to date. It may, thus, result in a lower overall shelter space requirement per person than we know how to attain in any other way. It may also cost less than any other method that realistically can be expected to prove acceptable to the population and effective in operation. It offers a reasonable basis for expecting that figures something like the now unsupportable 5 or 4 square-feet-per-person criteria mentioned in the Guide might prove workable.

So far as the factor of space alone is concerned, of course. I have not considered the limits, if any, that may be imposed on these envisioned space criteria by ventilation and temperature factors, and their interaction with this idea in its application. I have assumed that space is the prime and most costly concern, and that ventilation needs can be fulfilled in a cost-effective way in relation to such maximizing of space-utilization. I have dealt, therefore, with the problem of how we can get the most sleeping space per square foot of shelter floor space as an appropriate pay-off problem. I hope the measures under discussion will not be invalidated by inordinate ventilation technology and cost factors.

By putting together the findings that floor-sleeping is feasible, and that tiered bunks are advantageous, we get the notion of tiered floors. But since bunks require access aisles, we arrive at the idea of tiered shelves instead. If we now go to the idea of shelves of various lengths about 6 feet wide, used head-to-foot across their width, we get space that is similar to that of side-by-side or continuous bunks. Space not as nice as bunks provide, because it is not as individual, but it is far more productive of shelter sleeping space than that available from bunks. Continuous tiered sleeping stands (perhaps a better-sounding name than tiered shelves) are also likely to cost less than a bunk system. They might require fewer frame members. They might also offer better stability, a big problem of bunk systems that have been tried.

Shelf-sleeping is similar enough to floor-sleeping to prove similarly feasible. Such shelves would have a number of advantages over floors as a sleeping facility. Their built-in body-length configuration would make comparatively easy the management of a natural and much more efficient maximization of the use of shelf space as compared with the same amount of floor space. They would provide separation from the temperature and hardness austerity of floors that often are concrete. At low cost, tiered shelves would permit surfacing with corrugated fibreboard or an equivalent minimal hardness-insulation material. A little floor covering was found to make an important difference in tolerance for shelter.

Three-tiered stands would provide space at approximately a nine-square-foot-per-person standard, at a net floor-space cost of approximately 3 square feet per person; four-tiered stands would result in a net floor-space cost of about 2.2 square feet per person. Space for 2-foot parallel aisles, for some cross aisles, and for other operational functions, would of course have to be added to these figures in determining and evaluating the total floor-space requirements and economies that would accompany the use of tiered sleeping stands. These floor-space figures could then be used in relation to other factors and costs in calculating and deciding on the cost effectiveness of sleeping stands.

These figures provide a considerable advantage over those that have been derived from previous studies that used tiered bunks. Bunks occupy about 12 square feet, more or less, depending on the size selected. Shelter studies have used various sizes. (The Low-Cost Sleeping Facility study,²⁹ established the optimum bunk dimensions as 75x24, or 12.5 square feet. These dimensions exceed the 99th percentile of stature and "shoulder breadth measurements of the military population." Other military bunk sizes given in the study were: military liter, 72x22; troop ship bunk, 76x26-1/4; folding cot, 77-1/2x27; single bed 78x36. The Navy Bethesda study used bunks 78x27-1/2, with 20-inch spacing between them. Some bed sizes in a current major mail-order catalogue are as follows: twin bed, 39x75, or 20.3 square feet; single bed, the size of most of the folding cots, 30x75, or 15.6 square feet. Two of the cheapest models of folding cots are sold in two sizes; one is available in size 38 or 30x73-1/2. The other is sold in size 32, or 26x72. The smallest, 26x72, is 13 square feet.) Shelf-sleeping-space calculations could be based on allocations of about 9 square feet of sleeping space per person instead of the 12 or so provided by individual bunks. Even though some bunk designs that were tried or studied used continuous formations, and other various aisle-saving groupings, they all used the individual-bunk concept. They therefore could not be as economical of space as unseparated sleeping spaces on a continuous-shelf-configuration would allow.

The following additional factors and option combinations would affect these figures. These various configuration alternatives would result in different ratios of shelter space devoted to sleeping and to other functions. They would in turn result in different figures for per-person-space allocations for the shelter as a whole: whether the rooms or spaces with tiered shelves would be wholly or partially fitted with sleeping stands; whether they would be used for sleeping only or for other operational functions also; whether shift or partial-shift sleeping schedules would be used; whether aisle space required for ventilation would be greater than the minimum necessary for the sleeping function; whether the sleeping shelves would be demountable,

permitting multi-purpose use of the space; whether the aisles between sleeping shelves would include sufficient space for some other shelter functions. A useful by-product of options that would allow at least some of the sleeping stands to be available other than at sleeping times would be their use for shelteree rest, getting out of the way, and for a kind of privacy. It should be recognized that numerous different configurations and physical restrictions will be encountered in specific shelter spaces to which sleeping stands would have to be fitted.

6.2.3 Emergency Operations Planning

6.2.3.1 Operational Objectives and Shelter Management

"Taking prompt and effective action is facilitated by planning, which can reduce the reaction time of governments in an emergency. Planning consists of anticipating conditions or situations which may require action--when, where, and how they are likely to occur--as well as specifying what will be done, where, when, and by whom, to cope with these conditions or situations.

Operations is the process of carrying out the planned actions or other actions required by the actual situation as it develops." (FCDG, Part G, Ch 1, June 1968.)

This general objective of reducing reaction time in an emergency is particularly applicable and important to planning for shelter management operations. It is a main reason for concern about provision for shelter management. Reduction of reaction time is the touchstone against which many functions and essential characteristics of shelter management planning and operations can be determined. Prompt and effective action and reduction of reaction time are also main criteria for determining the standard of capability that shelter management will require if it is to perform these functions. This standard will in turn determine the extent and nature of the management recruitment and training that will be necessary; and the performance requirements of other preparations that are likely to be vital to accomplishment of the operational objectives of the shelter system. Reduction of reaction time is a basic objective and goal by which the potential and operating effectiveness of shelter management planning may be measured and evaluated.

Vital management measures will need to be taken in some shelter situations for combinations of reasons, within minutes of shelter entry. For example, measures may have to be taken before common-sense awareness of and reaction to heat-buildup hazard will develop. A delayed response of a leader who needs time to learn about and to react efficiently to problems may result in intolerable shelter conditions. Reaction time will be one of the factors of effectiveness of actions affecting protective, organizational, and habitability measures, which in turn can influence survival, health-guarding, and morale objectives of the shelter system.

In addition to the general planning objective of reducing reaction time, the FCDG establishes a considerable number of specifications and functions of shelter management that need to be planned for. Some of these are in themselves complex. Collected together they add up to an impressive set of planning requirements and expectations. They have been collected, and ordered with some analysis and comment, to demonstrate this point and to facilitate convenience in use, into Appendix C. A projection of what these expectations would require by way of a set of shelter management operational plans that would engender confidence in their validity as plans, and in the effectiveness with which they would work in operation, reveals a formidable requirement.

6.3 Additional Specific Proposed Changes and Improvements

6.3.1 Generic Idea

A number of considerations, evidenced in many places by the extensive quotations included above from the FCDG, merge to produce the idea that more of DCPA's effort on operational planning should be based on specific plans for individual shelter facilities, especially large ones. The larger the facility, the more complex will be its operation, and its technical and leadership personnel demands. The larger the facility, the more likely it is to vary in its major characteristics as shelter. Shelter facilities vary in configuration, location of protective areas, ventilation provisions and potential requirements, optimal per-person space allocation potential, equipment, water provisions and other

supplies important to shelter operations, organization of the people who normally occupy it--and the extent to which this organization will be useful during shelter occupancy--organization requirements for shelter operation, communications provisions and potential requirements, and many others. Examples of these variations and their operational implications, which require corresponding planning variations, recur in many places in this paper.

The FCDG states well, and repeats in many places, with examples of many applications, the concept of the necessity for adapting to and planning for the needs of specific community situations in operational planning. The FCDG should now extend this emphasis on individual community plans to include individual operational plans for all large shelters. The operating complexities, numerous functions, time and experience limitations, and variations in basic characteristics require individual operational plans for large shelters if there is to be a reasonable basis for expecting them to perform effectively the functions assigned to shelters by the FCDG.

A few examples that indicate recognition of this idea in the Guide, though it does not now go all the way to the same conclusion, may be worth repeating here to support the case:

"Specific management requirements will also depend upon the shelter configuration, status of supplies, availability and competence of the shelter leadership, and the shelter environment." (D,5.)

"Personnel should be trained only after local emergency planning has identified the specific skill requirements needed, job assignment to be made, and the total number needed." (B, 3, 1.)

Data to be pre-positioned in the Operations Room showing

"stocks of food and water in terms of man days by shelter complex . . . the staffing for each shelter complex; the type of communications existing between shelters and the complex headquarters . . ." (E, 2, 4, 6.)

"Review status of individual facility shelter-management plans or SOP's and develop or update as necessary, including provision of staffs needed to assist SM's." (G, 5, 15.)

"Review rosters, assignments, and alerting procedures for Shelter Managers (SM's) and supporting staffs, and update if necessary. Determine availability of SM's for duty if required, and determine deficit of SM's." (G, 5, 15.)

"Report on status of shelter and take corrective action (e.g., providing water . . .)." (G, 5, 15)

"Continue . . . work needed on shelter management plans or SOP's for individual shelter facilities." (G, 5, 15.)

The items on local Program Papers and Progress Reports:

"Shelter Facilities with Shelter Management Guidance Pre-positioned," "Shelter Facilities with Shelter Management Plans or SOP's." (B, 3, 2.)

"Localities having any facilities with 1,000 or more spaces should make a more exact estimate of their need for shelter managers for these larger facilities. Fewer shelter managers are needed, proportionately, for larger shelters." (B, 3, 2.)

Although the requirement of individual planning for large shelters is compelled by the complexity of their function as defined in the FCDG, as is the requirement for individual community shelter planning, and cannot be avoided in civil defense operational planning no matter how overwhelming the cost in effort and money might prove to be, the job of accepting and integrating this requirement may not really be as formidable as it appears at first blush.

First, to begin with, just as the DCPA Guide has tackled the problem of the much more complex CSP through the development of a set of analytical, descriptive, instructional and administrative materials, a corresponding set of guidance documents on operational planning for shelters, perhaps a companion set on Individual Shelter Planning, or ISP, can be produced. A basis for such guidance is available through extension and development of current FCDG content, and use of material in research reports.

The guidance material on qualifications and recruitment for shelter management should be revised so that the following points become basic and central. It should establish, as the highest priority

for shelter staffing, ways of maximizing the likelihood that large shelters will be under the control of people with the appropriate experience, status, and preparation. Means of approach should emphasize the necessity for personal contacts; and explanation of the need for individual shelter planning and the concept of executive shelter management. Some aspects of the problems and possible methods of selection and recruitment presented in Reference 118 should be considered. Corresponding changes will be needed in current material to reflect the changed role of the regular shelter manager in concept, planning, recruitment, training, operation, etc.

Revise the FCDG material on organization quoted above to include the concept of the "executive shelter manager," in addition to that of the "shelter manager." This concept, as well as others that form the basis for changes proposed in this paper is described in Reference 118. It emphasizes the need for the function of overall direction and control of the large shelter. To illustrate the tone and content of this referenced report, since a number of the proposed changes discussed here are based on it, the main statement explaining Executive Shelter Management is quoted below. One ESM is needed for every 1,000 sheltrees. Revision of material on recruitment, training, programming, and reporting, that corresponds to the addition of the executive shelter manager and a changed role for the shelter manager will also be necessary.

"Executive Shelter Management

"The first level is that which maintains overall command/control of the large shelter, a stratum that we have called executive shelter management. In any large social organization, successful occupancy of the top leadership rung requires different perspectives and modes of operation than are required in lower positions of leadership within the organization. There is every reason to believe that such differences will, if anything, be magnified within the organization of the fallout shelter. We believe that there exist ample experimental and field data to support the contention that the most difficult organizational goal to achieve and maintain under emergency conditions is overall direction and control. There usually is no shortage of activity in an emergency, but all too often,

"groups and individuals pursuing emergency tasks work at cross-purposes, inefficiently, or even aimlessly. There is a definite need for a level of leadership and management in shelters that is oriented to the 'big picture' and concerns itself with the overall status of resources --people, supplies, space, and the like. This need is above and beyond the other goals of shelter leadership and management that are dealt with in current shelter management training and guidance materials.

"We are convinced that executive shelter management positions should not be filled from the ranks of volunteers. We are equally convinced that in peacetime, the type of person who conforms to the requirements for executive shelter management will not make himself available for civil defense activities, in an overwhelming majority of cases. The highest priority in planning for shelter assignment and staffing at the local community should be to find ways to maximize the likelihood that in any emergency, shelters will actually be under the control of people with the appropriate experience, stature, and preparation to meet their emergency responsibilities.

"There is yet another important reason underlying the executive shelter management concept. Past AIR research reports have spoken about the desirability of 'natural' leadership. In other words, the environment for effective command/control in a shelter is improved if the management cadre is known and respected by the sheltrees. Using 'native' executive talent as shelter leaders increases the likelihood that this will occur."¹¹⁸

"We suggest the following plan. Organizations housed in buildings containing large public shelters should be approached and key officials briefed on local plans for IR operations. The concept of executive shelter management should be explained. All organizations should be asked to supply the names of key executives who would be placed in charge of the shelter in the event of an actual emergency (at least one executive manager for every 1,000 sheltrees). The understanding would be that these executives would not be required to participate in any peacetime preparedness activities. The commitment of the organization would extend to assurances that in a National emergency, shelter would be commanded by persons from the executive shelter management roster for that facility. The second level is that of the 'regular' shelter manager. Our conception of shelter management makes the 'regular' shelter manager (the product of the current Shelter Management (SM) training program) more necessary than ever. All we recommend is that he be given a more realistic mission."¹¹⁸(summary)

The quoted FCDG material on organization should further be revised to extend task and task-leadership functions in large shelters to include more specialists; for example, ventilation and resource management, as well as RaDef, police, fire, health, and welfare specialists now covered. The material on shelter management should also integrate the assignment, planning, control, and coordination aspects of the functions of the specialists now described separately in connection with discussions of operations of each of the various technical services. It should explain the shelter-complex concept, and how shelter managers would relate to the shelter complex.

Another basic change should be made in FCDG material on organization. It should provide for semi-autonomous groups, established in geographical subdivisions within large shelters, who operate on their own and solve their own problems to the greatest possible extent. They should aim at groups of about 300, with their own supplies, management, plans, and supports, as if they were in separate facilities, to the extent possible. These organizational units should be regarded as largely analogous, for planning, selection, training, and other purposes, to separate smaller shelter facilities of less than 300 capacity.

Second. The numbers may not be overwhelming when examined. Although, as of the end of FY 1967 there were about 175,500 located fallout shelter facilities with more than 50 spaces, only some 29,200 had a capacity of 1,000 or more. If we wanted to emphasize the largest first, the figures get even more feasible. We reduce the figure by nearly half, to some 15,700, for example, if we consider facilities with 2,000 or more spaces. Facilities with 2,000 or more spaces, comprising 9 percent of the total, contain 65.8 percent of the total number of spaces.

Third. What we are doing now instead is not an effective alternative route to the goal of operational planning for large shelter management. Persons qualified by executive experience to direct emergency situations in which the lives, suffering, and morale of a thousand or more persons might be at stake are not being recruited as shelter managers. Persons with executive experience are not taking the DCPA shelter management

or shelter management instructor courses. The courses cannot, because of the qualifications of their students, and their emphasis on small-shelter experience, qualify their students to lead and manage large shelter situations. One hundred thirty one persons took the Staff College Shelter Management Instructor Course in FY 1967. The CDUEP program certified 2,736 SMI's and 9,021 Shelter Managers in FY 1967.

A program of individual shelter planning might, in contrast, prove to be an effective alternative. For a number of reasons it has a better chance to be one.

Recruitment, a key factor, can be done in relation to a specific facility in which someone has a keen interest, and in relation to the creation of a specific operating plan. Recruitment of qualified executive shelter managers, which cannot be achieved without a clear communication of the range, depth, and complexity of the job, would come as a matter of course instead of the inappropriate recruitment represented by the qualifications of the students at the shelter management courses. Once aware of the nature of the job, executives would on their own initiative take on themselves responsibility for it. They would also then appoint technical staff support.

The process of working on the shelter management plan would achieve, as an additional product, excellent training; probably the most effective training we would be likely to get them to submit to. Additional DCPA training might also be built around the development and existence of these specific shelter plans. Conferences around these plans might also be developed eventually.

The important relationship of the job to a public program can be strengthened and formalized by appointments clothed with recognition and description of the public responsibility and authority it carries.

Numerous additional details, such as the maintenance of a system that surmounts personnel transfers, provision for inspection of shelter supplies, other planning factors represented by quotations from the FCDG listed above, along with many more that are important but not included in the Guidance would fall into place in the process of developing the necessary DCPA operational planning guidance.

Good plans would be produced by or with the help of executive shelter managers. We learned long ago that people with much organizational experience utterly failed to recognize its applicability when asked to apply it to a set of problems that was strange to them, like civil defense shelter management problems. Once given an appreciation for the content of the task, however, given a feel for the range and nature of the problems, some time to think about the, and some help in the form of basic guidance--people with organizational experience can be expected to bring it to bear toward the creation of truly valuable emergency shelter operations planning and preparation for individual shelters. A new DCPA program to provide this assistance, a twin to CSP called ISP, is suggested.

It may be that in some large shelter situations the concept of an executive shelter manager may appear inherently unsound and unworkable, and that some other organizational approach may obviously be necessary. This possible problem and alternative approaches can best be defined, thought about, and resolved in the process of carrying out a program that puts a high priority on and is directed at production of individual shelter organizational, management, and operational plans.

Fourth. A program of individual shelter planning should provide a more realistic basis for the enormous range and volume of increased readiness activities affecting shelter management now described in the FCDG. The increased readiness program is quoted above at length deliberately to suggest its logical implausibility. It is difficult to expect that it can succeed, that it will not fall of its own complexity and weight. The increased readiness program does not engender confidence that much more than sporadic and superficial improvements can be accomplished by way of shelter management planning and operations through its use. The building of an organization that can perform complex functions takes time. The program seems useful primarily as a reiteration and summary of the enormous job that needs to be done, and as a goad to the conscience of localities.

I believe a program of individual shelter planning would add a strengthened base for building a fundamental shelter operational

structure; and thus, in turn, strengthen the potential for the additional development and eventual effectiveness of an increased readiness program for shelter management planning and operation. A better operational base would permit better specifics in the IR plan, e.g., better statements on what exactly has to be done in a specific shelter facility to assure that water cans are filled in time of emergency; when, where, and by whom it should be done. Tied to a specific shelter operational plan that would be kept up to date, the IR plan could also be kept responsive to changes in personnel and shelter population, problems, and policies; it could be rehearsed in relation to specifics--a requirement of vitality, improvement, and confidence in its capability. A program of individual shelter planning would reveal, permit, and foster necessary relationships to IR planning. It would sharpen the distinctions in objectives, methods, capabilities, and limitations, and tend to prevent IR programs from being regarded as condensed and compressed versions of essential planning and activity programs. Different IR planning requirements and actions for large and small shelters would be better understood and, thus, more effectively achieved.

6.3.2 Other

1. The material in the FCDG on training shelter management staffs during the increased readiness period should be reviewed in the light of the questions and the specific and detailed principles and recommendations on such training presented in Reference 118. Adoption of the ISP program proposed above would involve basic adaptations in the content on both ongoing and IR training.

2. The FCDG material on provisions for assuring communications in shelter are remarkably sparse considering its importance and the numerous references in various places that imply its existence during operations. Announcements to the public are mentioned, for example, probably on the basis of a reasonable assumption that people will bring enough radios into shelters, but no explicit basis is stated. The problem of adequate telephones in large shelters, related to configuration,

management staff and structure, autonomy and size of shelteree groupings, functions they are to serve, etc., should have more discussion. Alternative communications provisions and requirements should also be treated in the FCDG.

3. Guidance on RaDef, and RaDef instruction manuals, should be revised to take cognizance of RaDef interaction with other vital needs in shelter such as ventilation requirements. Problems of conflicting subsystem planning and actions vital to shelter operations can be expected unless coordinated and cross-referenced guidance is made available and used. Guidance handbooks, and instructions on RaDef, should take account of the problem of achieving adequate knowledge about RaDef on the part of shelter management to warrant a basis for management evaluation of and action on RaDef information; and general direction of RaDef activities.

4. The problem of what to tell the public about shelter living by way of orientation aimed at maximally effective behavior in shelters, turns out to be important, complex, and difficult. It warrants further research before issuance of operational guidance on such orientations.^{121,125}

5. The basis for DCPA's program on prepositioning of supplies and shelter stocking needs fundamental review, the results of which should be reflected in the FCDG. The rationale for the program needs development. A restatement of the program would require revisions in the FCDG to maintain consistency of policy application.

The reasons and basis for use of the terms survival supplies and survival rations, including the possibility of discontinuation of their use in the FCDG, should be reviewed.

The effects of the stocking program on management problems and implementation, e.g., the printing of instructions on the packages in large enough letters, can profit from more development in the FCDG.

6. The FCDG on provisioning shelters should have two changes. Light in shelters--though much of it can be of very low levels, down to even 2-foot candles in general areas--is essential to shelter

operation and must be assured. Management and other functional areas, like medical dispensing, will require something like 10-foot candles. Light is also an important morale factor. If stockpiling of equipment may be necessary to guarantee light in shelters, then the stocking program should be changed to provide such a guarantee. The consideration and inclusion of emergency lighting devices as a supplemental item should accordingly be changed. To the sanitation kit should be added, either as an occasional stocked item or as a requirement on localities, some provision to assure toilet privacy where such provision does not otherwise exist.

7. The statement in the FCDG that "shelter occupancy tests have not indicated objection to the ration even though it is recognized to be a substantial departure from normal American diets," should be revised or omitted in view of much more substantial and later experience with problems of acceptability and use of the DCPA ration in occupancy studies since it was written. Reports of occupancy studies demonstrate the need for, and recommend: (a) greater palatability; and (b) greater variety; in DCPA's food.

The FCDG should give greater recognition to the morale requirement for food as a basic element of the objective, role, and nature of food in its shelter program. The morale reason for food is more important to the stated Program Objective for food than has been given effect in the FCDG implementation of this objective. Hot drinks and hot soup were clearly shown to be deeply important to morale, affecting physical and emotional well-being. The importance and ubiquitousness of hot coffee in disaster feeding in the U.S. are ingrained in custom and expectation. Its absence or availability in shelters will have an effect on morale.

The guidance on private fallout shelter foods should be revised to omit its higher "must" standard than that stated for DCPA-supplied food.

8. Material in the FCDG on Industrial Participation urgently needs to include guidance on its importance and its role in individual shelter planning for large shelters, and in selection and

recruitment of properly qualified appointees for large shelter management. Its current concepts and functional statements--that for Industrial CD Coordinators, for example--are inadequate for purposes of shelter planning. They should be extended to provide for the application of important industry resources to the basic function of specific planning for shelter facilities, many of which are large, and many of which are occupied by the controlling and operating organizations. The section of the chapter on Industrial Civil Defense that describes available guidance should include discussion of available guidance on shelter planning and management.

9. Consideration should be given to changing the guidance on using the sanitation kit fibre drum package for initial chemical toilets. The problem of leakage suggests the measure, though comparatively complicated, of transferring water and substituting metal water drums for the fibre drums.

10. The guidance on welfare services needs to be made consistent or better integrated with operational material in the FCDG. The material in the EWS guidance on EWS functions and responsibilities in shelters needs to be better integrated into the guidance for shelter management. For example, the concepts of Welfare Center Areas; registration; the use of shelters as special care centers and EWS operating centers immediately following shelter emergence; provision of social services; and the designation of the functions of feeding and assigning sleeping space as DPW functions, under the direction of the shelter manager; are not tied in descriptively with the functions of shelter management at the points in the FCDG where these are outlined. Ought the Licensing Agreement to mention the possibility of the use of shelters as special care centers after shelter emergence? What about the availability in shelters of registration forms, and the correlation of their design, methods, and purposes of use with shelter management plans?

If updating of the EWS materials prepared by DHEW is to be done in the future, its material on shelter should reflect better understanding of research data on functions and potential problems of shelter operation, and be better integrated with guidance for shelter management on organization and other subjects related especially to social services.

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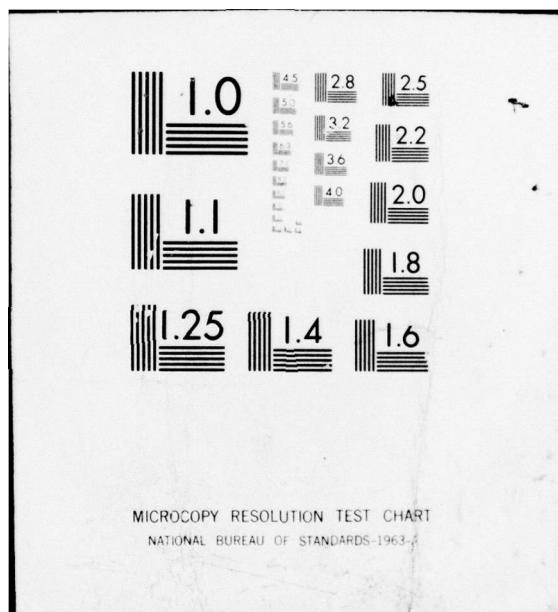
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